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UTGIVNINGSTIDER

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INNEHÅLLSFÖRTECKNING.

Avhandlingar, smärre uppsatser och meddelanden.

A = avhandling, *M* = mindre uppsats eller meddelande.

Sid.

AFZELIUS, B. M., ERDTMAN, G., and SJÖSTRAND, F. S., On the Fine Structure of the Outer Part of the Spore Wall of Lycopodium clavatum as Revealed by the Electron Microscope (Summary, p. 161) (*A*) 155

AFZELIUS, KARL, Embryo-Sac Development in Epipogium aphyllum (*A*) 513

ARNELL, S., New Hepatics Found in Sweden and Norway (*M*) 797

ARNOLD, CHESTER A., Fossil Sporocarps of the Genus Protosalvinia Dawson, with Special Reference to P. furcata (Dawson) comb. nov. (Summary, p. 299) (*A*) 292

ASCHAN, KARIN, Some Facts Concerning the Incompatibility Groups, the Dicaryotization and the Fruit Body Production in Collybia velutipes (Summary, p. 621) (*A*) 603

ASPLUND, ERIK, Carex Hultenii n. sp. (*A*) 95

—»—, Cobaea aequatoriensis n. sp. (*A*) 550

BÖCHER, TYGE W., Experimental Taxonomical Studies in the Arabis holboellii Complex (*A*) 31

DU RIETZ, G. EINAR, Sydväxtberg (Südpflanzenberge; Zusammenfassung S. 184) (*A*) 174

EMBERGER, L., Sur les Ginkgoales et quelques rapprochements avec d'autres groupes systématiques (*A*) 361

ERDTMAN, G., Some Remarks on Terms, Diagnoses, Classification, and Methods in Palynology (*A*) 471

—»—, On the Occurrence of Olacaceous Pollen Grains in Eocene Deposits in Germany (*M*) 804

—»—, se AFZELIUS, B. M., ERDTMAN, G., and SJÖSTRAND, F. S.

ERIKSSON, JOHN, Ramaricium n. gen., a Corticioid Member of the Ramaria Group (Summary, p. 198) (*A*) 188

FAGERLIND, FOLKE, The Apical Embryo- and Shoot-Meristem in Gnetum, Ephedra and other Gymnosperms (Summary, p. 468) (*A*) 449

FRIES, NILS, The Response of some Hymenomycetes to Constituents of Nucleic Acids (Summary, p. 576) (*A*) 559

FÅHRÆUS, GÖSTA, och STENLID, GÖRAN, Anteckningar om svampfloran i Älvkarleby (Some notes on the fungous flora of Älvkarleby, Uppland, Central Sweden; Summary, p. 794) (*A*) 771

Sid.

GENBERG, ERIK, Nytt fynd av Epipogium i norra Östergötland (A new find of Epipogium in northern Östergötland, southern Sweden) (*M*) 798

GOTHAN, WALTHER, Über ein Massenvorkommen von Sciadopitytes-Nadeln in kohligen Ablagerungen des oberen Jura oder Wealden der spanischen Ost-Pyrenäen (Zusammenfassung S. 342) (*A*) .. 337

HALLE, T. G., Notes on the Noeggerathiineae (*A*) 368

HARLING, GUNNAR, The Embryo-Sac Development of Vittadinia triloba (Gaud.) DC. (Summary, p. 494) (*A*) 489

HARRIS, TOM M., Mesozoic Seed Cuticles (Summary, p. 290) (*A*) 281

HASSELROT, KARL, Nytt fynd av Epipogium i Västergötland (A new find of Epipogium in Västergötland, southern Sweden) (*M*) ... 799

HASSELROT, T. E., Sumpviolen (Viola uliginosa Bess.) funnen i Stockholmstrakten (Viola uliginosa Bess. found in the vicinity of Stockholm) (*M*) 799

—»—, Ett par anmärkningsvärda Carex-fynd i Skepplanda socken i västra Västergötland (A couple of noticeable Carex finds from Skepplanda in western Västergötland, south-western Sweden) (*M*) 802

HEDBERG, OLOV, Taxonomic Studies in Afro-alpine Caryophyllaceae 199

HEMBERG, TORSTEN, The Auxine Balance during Germination in Untreated Maize Kernels and in Maize Kernels Treated with Indole Acetic Acid (*M*) 805

HULTÉN, ERIC, Sektion av 2400-årigt Sequoiaträd. Ett märkligt nyförvärv till Riksmuseets samlingar (Section of a 2400-year-old Sequoia tree for the collections of the Museum of Natural History, Stockholm; Summary, p. 446) (*A*) 429

—»—, Arkiv av utbredningskartor i Naturhistoriska Riksmuseets botaniska avdelning (An archive of maps showing the distribution of plants has been gradually built up at the Botanical Department of the Swedish Museum of Natural History, Stockholm; Summary, p. 804) (*M*) 802

HYLANDER, NILS, Apans stege och Pyrrhas hår. Några reflexioner över botaniska artnamn med tvåordsepitet samt en förteckning över en grupp av sådana. ("Ape's ladder" and "Pyrrha's hair". Reflexions on botanical species names with biverbial epithets, and a list of a special group of such names; Summary, p. 547) (*A*) . 521

HÅRD AV SEGERSTAD, F., Sparganium fluitans — glomeratum — affine. En segsliten nomenklaturfråga (Sparganium fluitans — glomeratum — affine. Eine schwer zu lösende Nomenklaturfrage; Zusammenfassung S. 629) (*M*) 626

JOHANSSON, ALLAN, Fynd av brandnäva i Åker (Finds of Geranium lanuginosum in Åker, Södermanland, Central Sweden) (*M*).... 798

JONGMANS, W. J., Some Interesting Plants in the Zechstein of the Boring Oostzaan I (The Netherlands) (*A*) 325

JÖNSSON, GUSTAF, se MALMSTRÖM, CARL, och JÖNSSON, GUSTAF.

Sid.

KOTILAINEN, MAUNO J., Den enda säkra växtplatsen för Kobresia simpliciuscula (Wahlenb.) Mack. i Fennoscandia orientalis (The only positive locality for Kobresia simpliciuscula (Wahlenb.) Mack. in Fennoscandia orientalis) (*A*) 19

KRÄUSEL, RICHARD, Paläobotanische Eindrücke in Süd- und Südwest-Afrika (*A*) 344

LAM, H. J., Again: The New Morphology — Elucidated by the most Likely Phylogeny of the Female Coniferous Cone (*A*) 347

LECLERCQ, S., Are the Psilophytales a Starting or a Resulting Point? (*A*) 301

LOHAMMAR, GUNNAR, The Distribution and Ecology of Fissidens julianus in Northern Europe (Summary, p. 172) (*A*) 162

—»—, Bulbils in the Inflorescences of Butomus umbellatus (*A*) 485

LOURTEIG, ALICIA, Two New Species of Cuphea from Bolivia (*A*) 83

LUNDBLAD, BRITTA, Contributions to the Geological History of the Hepaticae. Fossil Marchantiales from the Rhaetic-Liassic Coalmines of Skromberga (Prov. of Scania), Sweden (Summary, p. 411) (*A*) 381

LUNDH-ALMESTRAND, ASTA, Melosira islandica and M. granulata in the Scanian Lake Ringsjön (*A*) 591

LUNDMAN, BERTIL, Några iakttagelser över Uppsalatraktens Corydalis-former (Some observations on Corydalis in the vicinity of Uppsala) (*M*) 235

—»—, Några notiser om Polygala vulgaris ad serpyllifoliam i Sverige (Some notes on Polygala vulgaris ad serpyllifoliam in Sweden) (*M*) 238

LÖVE, ÁSKELL, Cytotaxonomical Remarks on some American Species of Circumpolar Taxa (Summary, p. 228) (*A*) 211

MAC KEY, JAMES, The Taxonomy of Hexaploid Wheat (Summary, p. 588) (*A*) 579

MALMSTRÖM, CARL, och JÖNSSON, GUSTAF, Klockljung (Erica Tetralix) funnen vid Skinnskatteberg i Västmanland (Erica Tetralix found at Skinnskatteberg in Västmanland, Central Sweden) (*M*) 233

MELIN, ELIAS, Growth Factor Requirements of Mycorrhizal Fungi of Forest Trees (*A*) 86

MELIN, ELIAS, and NILSSON, HARALD, Transport of Labelled Phosphorus to Pine Seedlings through the Mycelium of Cortinarius glaucopus (Schaeff. ex Fr.) Fr. (*A*) 555

NILSSON, HARALD, se MELIN, ELIAS, and NILSSON, HARALD.

NORDHAGEN, ROLF, Apologi for Poa stricta Lindeb. (Apology for Poa stricta Lindeb.) (*A*) 1

NORDIN, INGVAR, Botaniska exkursionsanteckningar från Västmanland (Notes from botanical excursions in Västmanland, Central Sweden) (*M*) 632

NORLINDH, TYCHO, Further Contributions to the Genus Osteospermum (*A*) 148

Sid.

Olsson, Axel, Selaginella selaginoides och Nymphoides peltatum i Östergötlands skärgård (Selaginella selaginoides and Nymphoides peltatum in the archipelago of Östergötland, south-eastern Sweden) (*M*) 239

Óskarsson, Ingimar, Studies on Hieracium demissum (Strömf.) Dahlst. (Conclusions, p. 62) (*A*) 45

Potonié, Robert, Gibt es angiospermide Eigenschaften an paläozoischen Sporen? (*A*) 328

Raymond, Marcel, What is Eriophorum Chamissonis C. A. Meyer? (*A*) 65

Rune, Olof, Notes on the Flora of the Gaspé Peninsula (Conclusions, p. 130) (*A*) 117

Ryberg, Måns, En sörmländsk hagtornsskog och några ord om Crataegus-formerna i Södermanlands kustland (A hawthorn wood — some notes on the Crataegus forms in the coastal district of Södermanland, Central Sweden) (*A*) 502

Segelberg, Ivar, Atriplex sabulosa i Halland (Atriplex sabulosa in Halland, south-western Sweden) (*M*) 246

Sjöstrand, F. S., se Afzelius, B. M., Erdtman, G., and Sjöstrand, F. S.

Skottsberg, C., On the Supposed Occurrence of Blechnum longicauda C. Chr. in Brazil (*A*) 418

Stenlid, Göran, se Fåhræus, Gösta, och Stenlid, Göran.

Sterner, Rikard, Flora och vegetation i Allgunnenområdet i östra Småland (Flora and vegetation of the Allgunnen district of eastern Småland, southern Sweden) (*A*) 104

Söderberg, Erik, Notis om variationen i stiftens antal hos Stellaria longipes Goldie och S. monantha Hultén (A note on the variation of the number of styles in Stellaria longipes Goldie and S. monantha Hultén) (*A*) 99

—»—, Om cellinnehållet i gymnospermernas och chlamydospermernas endosperm (On the cell content in the endosperm of the Gymnosperms and Chlamydosperms) (*A*) 497

Thomas, H. Hamshaw, The Plant on which the Genus Pachypteris was Founded (*A*) 316

Westfeldt, G. A., Floran i nordöstra delen av Sjuhäradsbygden (The flora of the north-eastern part of Sjuhäradsbygden, Västergötland, south-western Sweden; Summary, p. 767) (*A*) 649

Wijk, Hjalmar, Hederastudier i norra Halland (Studies on Hedera in northern Halland, south-western Sweden) (*A*) 137

Willén, Torbjörn, Fynd av Chara tomentosa L. och ett par andra alger från Björklinge-Långsjön, Uppland (Finds of Chara tomentosa L. and some other algae in the lake Björklinge-Långsjön, Uppland, Central Sweden) (*M*) 630

Woldmar, S., Om utbredningen i Norden av gråkremling, Asterophora parasitica (Bull. ex Fr.) Sing. (On the North European distribution of Asterophora parasitica (Bull. ex Fr.) Sing.; Summary, p. 602) (*A*) 596

Recensioner.

Sid.

Bünning, E., Lehrbuch der Pflanzenphysiologie. II. und III. Band: Entwicklungs- und Bewegungsphysiologie der Pflanze (Rec. av Börje Åberg) 639
Crafts, A. S., Currier, H. B., and Stocking, C. R., Water in the Physiology of Plants (Rec. av Börje Åberg) 638
Dony, John G., Flora of Bedfordshire (Rec. av Sten Ahlner) 259
Fogg, G. E., The Metabolism of Algae (Rec. av Sven Österlind) 257
Gilmour, John, and Walters, Max, Wild Flowers. Botanising in Britain (Rec. av Sten Ahlner) 647
Good, Ronald, The Geography of the Flowering Plants (Rec. av C. Skottsberg) 248
Helmcke, J.-G., und Krieger, W., Diatomeenschalen im elektronenmikroskopischen Bild. I (Rec. av R. W. Kolbe) 261
Holttum, R. E., Plant Life in Malaya (Rec. av Gunnar Harling) 642
Kinnekulle (Rec. av Sten Ahlner) 260
Natur i Dalsland. Under redaktion av Nils-Gerhard Karvik och Kai Curry-Lindahl; Natur i Ångermanland och Medelpad. Under redaktion av Olof Elofson och Kai Curry-Lindahl (Rec. av Sten Ahlner) 257
Overholts, L. O. (†), The Polyporaceae of the United States, Alaska and Canada (Rec. av John Axel Nannfeldt) 646
Ramsbottom, J., Mushrooms & Toadstools. A Study of the Activities of Fungi (Rec. av John Axel Nannfeldt) 262
Reed, Howard S., Jan Ingenhousz, Plant Physiologist. With a History of the Discovery of Photosynthesis (Rec. av Börje Åberg) 633
Ross-Craig, Stella, Drawings of British Plants. Part V, VI (Rec. av Måns Ryberg) 642
Strasburger, Noll, Schenck und Schimper, Lehrbuch der Botanik (Rec. av Gunnar Harling) 641
Symposia of the Society for Experimental Biology. Number V: Carbon Dioxide Fixation and Photosynthesis (Rec. av Börje Åberg) 635
Symposion on Chromosome Breakage (Rec. av Axel Nygren) 256
Wardlaw, C. W., Phylogeny and Morphogenesis (Rec. av Britta Lundblad) 644

Sammankomster år 1953.

Botaniska Föreningen i Göteborg 264
Botaniska Sektionen av Naturvetenskapliga Studentsällskapet i Uppsala 266
Botaniska Sällskapet i Stockholm 267
Botanistklubben vid Stockholms Högskola 268
Societas pro Fauna et Flora Fennica 269
Svenska Växtgeografiska Sällskapet 272

Svenska Botaniska Föreningen.

Sid.
Föreningens sommarexkursion till Kolmården 1953 (Bertil J. O. Wahlin) 273
Föreningens höstexkursion på Djurgården den 12 september 1953 (Einar Ingelström) 278
Revisionssammanträde 279
Årsmötet 1953 279
Nya medlemmar 280

Diverse.

Notiser 807

ARTFÖRTECKNING.

I nedanstående förteckning ha i regel endast sådana arter upptagits, som i något avseende blivit utförligare behandlade, som helt eller delvis avbildats, eller vilkas nomenklatur berörts. Nya systematiska enheter ha markerats med fetstil, helt eller delvis avbildade eller karterade arter med asterisk.

Sid.

Abies magnifica* 482
A. Mariesii* 482
A. nephrolepis* 482
Anacolosidites efflatus 805
Anemia adiantifolia* 479
A. anthriscifolia* 479
A. phyllitidis* 479
Anemone ranunculoides* 679
Angiopteris longifolia* 477
Arabis Collinsii* 40
A. divaricarpa 40
A. divaricarpa × Holboellii* .. 40
A. Holboellii* 31
A. Holboellii v. **tenuis*** 38
A. Holboellii v. tenuis f. **glabra*** 38
A. retrofracta* 38
Archangiopteris Henryi* 477
Asterophora parasitica* 596
Atriplex sabulosa 246

Batrachospermum moniliforme* 630
Blechnum longicauda* 418
B. Sprucei* 419
Boletus bovinus* 88
B. luteus* 88
B. variegatus* 91
Brachypodium pinnatum* 661
Bucheria ovata* 305
Butomus umbellatus* 485

Carex Buxbaumii 802
C. caespitosa* 668
C. capillaris* 666

Sid.

Carex echinata 219
C. flacca* 666
C. **Hultenii*** 95
C. jemtlandica* 23
C. lepidocarpa* 668, 802
Cedrus atlantica* 482
C. deodara* 476
Centaurea ruthenica* 482
Chara tomentosa* 630
Chenopodium hybridum 219
Christensenia aesculifolia* 477
Cirsium oleraceum* 679
Cobaea **aequatoriensis*** 550
Collybia velutipes* 603
Confusopollis confusus* 482
Cortinarius glaucopus 555
Corydalis laxa 235
C. pumila 235
C. solida 235
Crataegus calycina* 507
C. curvisepala* 507
C. monogyna* 507
C. oxyacantha* 507
Cuphea **mapirensis*** 83
C. **Rusbyi*** 84
Cypripedium calceolus* 26

Danaea elliptica* 477
Dracocephalum ruyschiana* .. 658

Epipactis palustris* 666
Epipogium aphyllum* 513, 798, 799
Erica tetralix 233
Eriophorum Ser. **Anderssonia** 77

	Sid.
Eriophorum Ser. **Appressa** ...	76
Eriophorum Ser. **Fernaldiana** .	76
Eriophorum Ser. **Hultenia**	77
Eriophorum Ser. **Pallaeana** ...	77
Eriophorum Ser. **Reflexa**	76
Eriophorum Chamissonis*	65
E. Chamissonis f. **Turneri**	79
E. × medium	80
E. russeolum*	72
Fissidens julianus*	162
Fragaria viridis*	661
Gagea minima*	679
Galium boreale	228
Geranium lanuginosum	798
Ginkgo biloba*	364
Glyceria **Hulteniana**	218
G. maxima	216
Gnetum gnemon*	463
G. nodiflorum*	464
G. Schwackeanum*	451
Grimaldia fragrans*	398
Hedera helix*	137
Hedwigia ciliata*	479
Hedwigidium integrifolium* ...	479
Heleocharis **Fernaldii**	218
H. quinqueflora	218
Hemitelia Maxonii*	330
Hieracium demissum*	45
H. demissum v. **macroramosum***	51
Juncus triglumis*	26
Keteleeria Davidiana*	482
Kobresia simpliciuscula*	19
Lathyrus palustris	226
Lentinus lepideus	560
Lomaria caudata*	420
Lophozia excisa v. **grandiretis**	797
L. latifolia	797
L. opacifolia	797
Lycopodium clavatum*	155
L. diaphanum*	156
Lygodium circinnatum*	479
Lygodium japonicum*	479
L. micans*	479
L. volubile*	479
Macroglossum Alidae*	477
Marattia fraxinea*	477
Marchantiolites	393
M. **porosus***	393
Melosira granulata*	591
M. islandica*	591
Mohria caffrorum*	479
Mycena flavo-alba	560
M. rubromarginata	560
Myriophyllum exalbescens* ...	227
M. spicatum*	227
Noeggerathia foliosa*	370
Noeggerathiostrobus bohemicus*	370
Nymphoides peltatum*	243
Ophioglossum coriaceum*	478
Orchis incarnata*	679
O. Traunsteineri*	679
Orthocaulis cavifolius	797
Osteospermum acutifolium* ..	152
O. **afromontanum***	149
O. **angolense***	148
Oxymitra pyramidata*	398
Pachypteris lanceolata*	320
Paranomus sceptrum-gustavianum	546
Pedicularis sceptrum-carolinum*	674
Peniophora fraxinea	560
Pentaphylloides fruticosa	222
Phleum phleoides*	661
Phyllitis **Fernaldiana***	214
Ph. scolopendrium*	213
Piaea gigantea*	325
Picea hondoensis*	473
Pinus excelsa*	474
Plagiochasma rupestre*	398
Pleurospermum austriacum* ..	276
Poa arctica	1
P. stricta*	1

	Sid.
Polygala amarella*	666
P. serpyllifolia	238
P. vulgaris	238
Polyporus abietinus	560
P. annosus	560
Potamogeton bupleuroides*	215
P. perfoliatus*	215
P. Richardsonii*	215
Potentilla norvegica	224
Primula farinosa*	668
P. veris*	661
Protosalvinia furcata*	292
P. ravenna*	292
Pseudolarix Kaempferi*	475
Psilophyton princeps*	305
P. pubescens*	305
Pulmonaria angustifolia*	658
Pulsatilla Ludoviciana*	221
P. patens*	219
Ramaricium	189
R. **occultum***	196
Riccia Curtisii*	417
R. Warnstorfii*	389
Ricciisporites	400
R. **tuberculatus***	401
Ricciocarpus natans*	389
Ricciopsis	387
R. **Florinii***	387
R. **scanica***	391
Russula xerampelina*	90
Sagina abyssinica*	207
S. abyssinica ssp. **aequinoctialis**	208
S. **afroalpina***	209
S. brachysepala*	207
Salix depressa*	674
S. hastata*	674
S. reticulata*	27
Saussurea alpina*	674
Saxifraga aizoides*	23
Schizaea fluminensis*	479
S. melanesica*	479
Schoenus ferrugineus*	668
Schopfipollenitis*	333
Sciadopitytes*	337
Selaginella selaginoides*	158, 240
Sequoia gigantea*	429
Sparganium affine	626
S. fluitans	626
S. glomeratum	626
Stellaria Brauniana*	202
S. emirnensis*	202
S. longipes*	99
S. monantha*	99
Tetradosulcites magna*	480
Thallites*	396
Tribulus cistoides*	472
Trifolium montanum*	658
Trigonella melilotus-corniculatus	546
T. melilotus-creticus	546
Triticum aestivum	579
Ullmannia Bronnii*	326
Viola rupestris*	658
V. uliginosa*	799
Vittadenia triloba*	489
Zosterophyllum fertile*	305

Eric Hulton

ERIC HULTÉN

60 ÅR

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APOLOGI FOR POA STRICTA LINDEB.

av

ROLF NORDHAGEN.

I 1854 oppdaget den skarpsynte C. J. Lindeberg på Knutshø i Drivdalen (Dovrefjell) en *Poa* som han det følgende år beskrev i Botaniska Notiser som *P. stricta*. I de 100 år som senere er forløpet, har atskillige forskere beskjeftiget seg med dette interessante gras. Gjennom J. A. Nannfeldts betydningsfulle avhandling fra 1940 ble det klarlagt at Otto R. Holmbergs oppfatning av *Poa stricta* som en hybrid mellom *P. arctica* og *P. flexuosa* var uholdbar. Nannfeldt kunne dessuten vise at *P. stricta* er en sørnorsk endemisme. Gjennom undersøkelser foretatt av norske botanikere i Oslo og Trondheim i de siste 15 år har det vist seg at *P. stricta* har en større utbredelse enn tidligere kjent; men den må fremdeles sies å ha sitt »massecentrum» på fjellene i Drivdalen. Sydgrensen ligger på Søndre Knutshø, nordgrensen på Finnpiggene (jfr. Gjærevoll 1950), som ligger nord for Oppdal kirke. Østgrensen på Grønhø i Tynset er fastlagt av Johannes Lid; vestgrensen ligger sannsynligvis ved Tythø og Raudhø ca. 13 km nordøst for Snøhettas topp. På disse to fjell fant jeg den i mengde sommeren 1947, derimot lyktes det meg ikke å finne den på fjellene i Åmotsdalen lenger vest, heller ikke i Grøvudalsfjellene. Bortsett fra Finnpiggene i Oppdal er *Poa stricta* ikke funnet nordenfor Driva, altså ikke i det egentlige Trollheimen-område (se fig. 2).

Nannfeldt degraderte imidlertid i 1940 Lindebergs art til en subspecies av *Poa arctica* R. Br. Nylig har Nils Hylander (1953) gått enda lenger, idet han reduserer den til en varietet. Etter min overbevisning er dette uholdbart. Morfologisk sett er *Poa stricta* en meget distinkt type, som man alltid vil kunne identifisere ute i naturen etter en smule øvelse. Blant Sør-Norges taxa av *Poa*-seksjonen *Pandemos* A. & Gr. (jfr. Hylander 1953 p. 255–261) kan

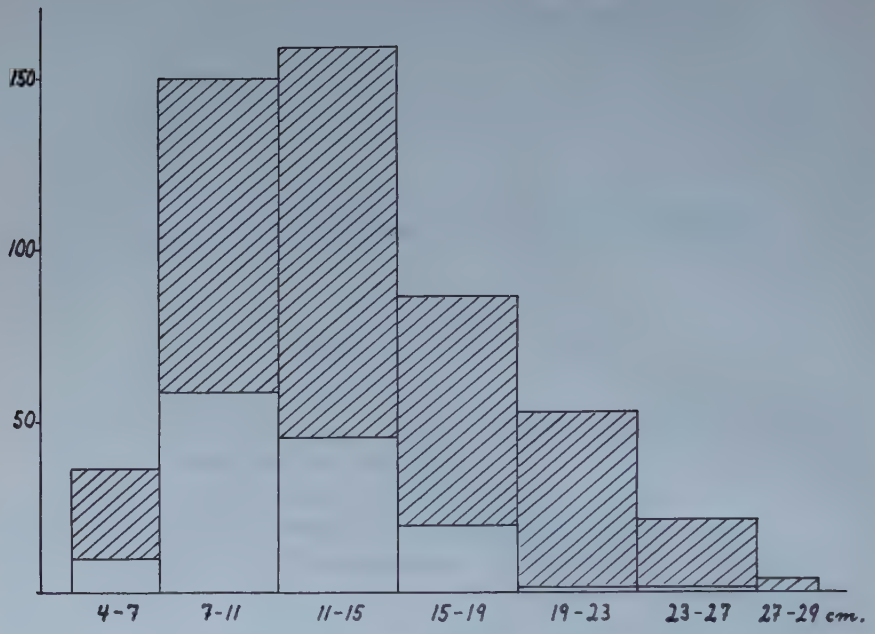

Fig. 1. Grafisk fremstilling av *Poa stricta*'s høyde (strålengde). De hvite kolonner viser målinger utført på 134 strå samlet i juli; de skraverte kolonner refererer seg til 370 strå samlet i august måned.

P. stricta aldri forveksles ute i naturen hverken med *P. pratensis*-komplekset eller *P. arctica*-kompleksets ikke-vivipare representanter, heller ikke med de vivipare hybrider *P.* ×*jemtlandica* og *P.* ×*herjedalica*. Jeg bortser her fra nybegynnere, for hvem fjellets *Poa*-flora alltid er et vanskelig kapitel, og tenker på erfarne fjellbotanikere.

Poa stricta's morfologi er skildret av NANNFELDT på en måte som jeg etter egne erfaringer gjennom 40 år vil betegne som tilfredsstillende. Dog synes innledningsordene i hans diagnose meg å være noe vill-ledende: »Coarse, medium-sized, mostly 20–30 cm high when full grown, forming large and dense tufts . . .» Heller ikke ordene: »Leaves rather broad . . .» stemmer med min egen erfaring. Jeg må gi JOHANNES LID rett når han i siste utgave av sin flora (1952) uttaler at *Poa stricta* opptrer i »låge tuver», henholdsvis »lause tuver», og har »smale blad». Uttrykkene »coarse» og »large tufts» betegner overdrivelser, for i de fleste tilfelle fremtrer *Poa stricta* ikke som noe robust eller særlig kompakt gras. HYLANDERS karakteristikk av stråene som »grove» passer slett ikke (jfr. NANNFELDTS fotografier

1940, plansje IX–XI), og den reservasjonsløse angivelse av høyden til 20–30 cm er meget forvirrende, for unntatt særlig varme sommrer (og enkelte subalpine voksesteder på elvebredder) er *Poa stricta* å betegne som et lavt gras. Hos Lid angis høyden til 10 cm; dette er imidlertid i snaueste laget. Jeg har latt foreta en del målinger på det rikholdige materiale som finnes i Oslo-herbariet, og delt det i 2 grupper: (1.) kollekter fra juli måned, og (2.) kollekter fra august. Målingene, som er utført av stipendiat F. Wischmann, ga for 134 strå samlet i juli: minimum 4 cm, maximum 19,5 cm, mens den aritmetiske middelverdi var 11,4 cm. For august ga 370 strå: minimum 4 cm, maximum 28 cm, middelverdi 14,1 cm. Fig. 1 viser resultatet i grafisk fremstilling. Innenfor det målte august-materiale viste bare 11,3 % en høyde fra 20–25 cm, og bare 2,2 % en høyde fra 25–28 cm.

Sammenligner man *Poa stricta* med *Poa arctica* **depauperata* (Fr.) Nannf. og **elongata* (Bl.) Nannf., er den morfologiske forskjell, bortsett fra viviparien, slående: begge disse underarter har lange, tynne, gulhvite utløpere (suboles), som kryper nede i marken eller under mosetepper. Utløperne betinger den særmerkte »spredte» voksemåte som nettopp utmerker de nevnte to underarter. *Poa stricta* har mange ekstra- och intravaginale skudd, men bare korte utløperskudd, noe som skaper en helt annen voksemåte: den er løst småtuet. Ellers utmerker *Poa stricta* seg ved temmelig sterk anthocyanfarge; både bladslirene, bladene, strået og blomsterstanden har gjennomgående et markert mørkfiolett–rødaktig anstrøk. Denne egenskap har Hylander ikke tatt med i sin diagnose, og dog er den meget viktig f. eks. ved identifiseringsarbeid under plantesociologiske analyser.

Ellers er vel *Poa stricta*'s kanskje mest oppsiktsvekkende egenskap dens lave kromosomtall (2n = 38, 39), det laveste som hittil er påvist blant de nordiske taxa av seksjonen *Pandemos*.

Når jeg personlig mener at *Poa stricta* Lindeberg fortjener å opprettholdes som egen art og ikke bare sidestilles de ikke-vivipare taxa *P. arctica* **depauperata* og **elongata* som underart eller varietet, er det kanskje først og fremst ut fra en økologisk vurdering. *Poa stricta* har nemlig en i forhold til **depauperata* og **elongata* helt forskjellig økologisk amplitude. Dette vil enhver som f. eks. avlegger besøk på Knutshø, Nystuhø, Raudhø, Tythø, Kvernbekkhø og Sisselhø (Drivdalsfjellene) meget snart bli oppmerksom på. Allerede Nann-

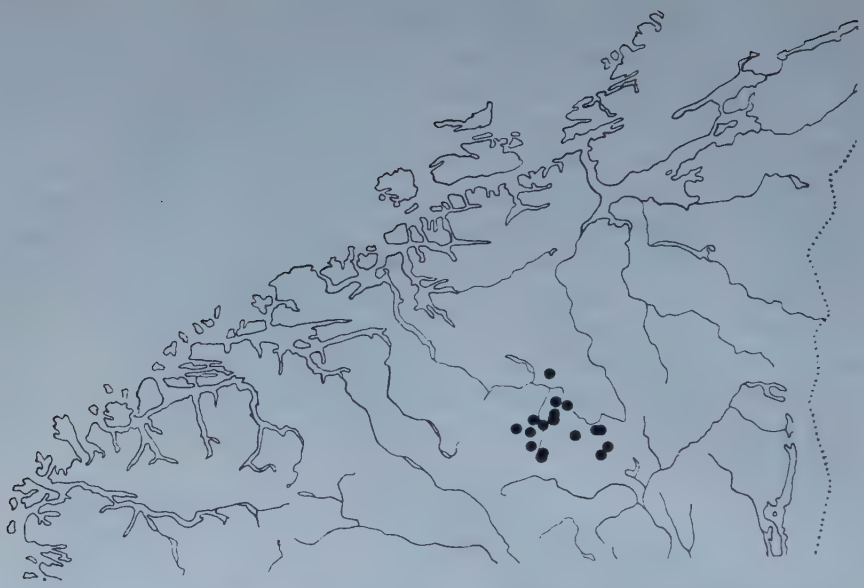

Fig. 2. Utbredelsen av *Poa stricta* LINDEB. (Original, Bot. Museum, Oslo.)

FELDT (1940 p. 14–15) har, i tilslutning til sine egne iakttagelser og visse plantesamfunnsanalyser som jeg i 1939 stilte til hans disposisjon, trukket den slutning at *Poa stricta* »is absolutely dependent upon a plentiful supply of water . . .». Min erfaring er at *Poa stricta* overhodet ikke er konkurransedyktig og ikke trives på tørr mark. Om *Poa arctica* **depauperata* og **elongata* derimot kan jeg i henhold til mine vegetasjonsanalyser og andre iakttagelser på Drivdalens fjell med sikkerhet uttale at disse trives fortreffelig i mellomalpine plantesamfunn på tørr mark; ja de har sitt egentlige dominansareal i lavrike samfunn som ellers ikke oppviser en eneste hygrofytt. Imidlertid opptrer disse to underarter også i samfunn på frisk mark, ja av og til også i våte mosetepper. Ikke sjelden kan derfor *Poa stricta* og de nevnte to underarter av *Poa arctica* treffes i de samme plantesamfunn. Men *Poa stricta* forsvinner totalt på tørr mark, og den opptrer heller ikke i kortvoksne fjellenger på frisk bunn.

Hertil kommer *Poa stricta*'s forkjærlighet for snoleiemark. De plantesamfunn som i Drivdalsfjellene oppviser konstant eller dominant *Poa stricta* på prøveflater à 1 m², må karakteriseres som en slags snøleiesamfunn.

I det følgende skal jeg prøve å belyse denne økologiske forskjell ved hjelp av ruteanalyser. Beklageligvis er mitt rutemateriale fra de

lavrike, mellomalpine samfunn med dominerende *Poa arctica* på Knutshøene (Nordre, Midtre og Søndre K.) ikke særlig representativt. Men enhver som bestiger toppen av f. eks. Søndre Knutshø, vil ved selvsyn kunne overbevise seg om hvilke ufattelige mengder av *Poa arctica* det er som her stikker opp av lavteppene. Nedenfor har jeg stilt sammen analyser av 15 ruter à 1 m² fra tre forskjellige bestand, som ligger i 1550–1600 m.s høyde i temmelig flatt terreng på Nordre Knutshø. Det dreier seg om en *Poa arctica-Luzula arcuata-Salix herbacea* (-*polaris*)-*Alectoria ochroleuca*-sociasjon. Det første bestand utmerket seg ved konstant *Artemisia norvegica* (dette er et av de høyestliggende voksesteder for denne art i Knutshømassivet) og *Campanula uniflora*, dessuten ved høy dekningsgrad for *Gymnomitrium corallioides*, noe som skyldes sterk vindvirkning fra nord og tynt snødekke i vinterhalvåret. Det annet bestand utmerket seg ved en i forhold til den store høyde over havet betydelig dekningsgrad for *Festuca vivipara* og ved konstans av *Carex rupestris* (i ubetydelige mengder). I bestand III var lavteppet voldsomt kraftig utviklet, og i alle tre bestand kom *Salix herbacea* og dens hybrid med *S. polaris* først til syne når man fjernet lavmatten. Underlaget var småsteinet morenegrus. Allerede av lavteppets sammensetning kan man se at det her dreier seg om en snøsky (chionofob) sociasjon. Under analysearbeidet måtte *Poa arctica* **depauperata* og **elongata* slås sammen til ett taxon, da det var umulig å holde dem ut fra hverandre i hvert enkelt tilfelle.

I noe lavere høyder i Knutsho-massivet treffer man atskillige steder praktfulle *Dryas*-heier. Disse er dels mosrike, dels lavrike (men dog med sterk tilblanding av moser). I begge typer opptrer *Poa arctica*, men sjelden med høyere dekningsgrad enn I–II pr. 4 m². Jeg disponerer over 12 ruteanalyser fra disse fantastisk artsrike *Dryas*-bakker; men *Poa arctica* er her ikke konstant på 4 m². På steder utsatt for sterk vindvirkning avløses disse *Dryas*-heier av *Kobresia myosuroides*-grasheier av sterkt xerofilt preg. På Knutshø dreier det seg bare om mindre flekker, og i mine analyser er *Poa arctica* representert, men bare som en helt uvesentlig bestanddel og i sterkt depaupererte former. I de praktfulle *Kobresia myosuroides*-grasheier som utmerker visse fjell vest for Drivdalen (f. eks. Store Åmotshytten), i Trollheimen og Sunndalsfjellene, har jeg ikke funnet *Poa arctica*. Noen typisk xerofytt er derfor denne art ikke; dette gjelder både subsp. *depauperata* og subsp. *elongata* (se nedenfor).

På Knutshø finner man i forsenkninger i *Dryas*-heier enestående

Tabell I. Poa arctica - Luzula arcuata - Alectoria ochroleuca - sociasjon. Nordre Knutshø, 29.–30. juli 1946.

Bestandsnummer:	I					II					III					K%	D
Rutenummer:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
Poa arctica (excl. *P. stricta*) ..	2	2	1	2	2	2	2	2	1	3	3	2	3	3	2	*100*	2+
Festuca vivipara	1	1	1	1	1	3	2	3	3	3	–	–	1	–	–	73	2
Poa flexuosa	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	7	1
Trisetum spicatum	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	7	1
Luzula arcuata coll.	2	2	2	2	2	2	3	3	2	2	3	3	2	3	3	*100*	2+
L. spicata	1	1	1	1	1	–	–	–	–	–	–	–	–	–	–	33	1
Artemisia norvegica	3	3	2	3	3	–	–	–	–	–	–	–	–	–	–	33	3÷
Campanula uniflora	1	1	1	1	1	–	–	–	–	–	–	–	–	–	–	33	1
Cerastium alpinum	1	1	1	–	1	1	1	–	–	1	–	1	–	1	–	60	1
Draba alpina	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	7	1
D. fladnizensis	–	–	–	–	–	–	1	1	–	1	–	–	–	–	–	20	1
Lycopodium selago	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	7	1
Melandrium apetalum	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	7	1
Pedicularis Oederi (oftest ster.)	1	1	–	–	1	1	1	1	1	1	–	1	1	–	–	67	1
Polygonum vivipar. (depaup.)	1	1	1	1	1	–	1	–	–	–	1	1	2	1	1	73	1
Potentilla Crantzii	–	–	–	–	–	–	1	1	1	1	–	–	–	–	–	27	1
Ranunculus glacialis (depaup.)	–	–	1	–	–	–	1	1	1	1	1	1	1	1	1	67	1
Salix herbacea	3	3	4	3	3	3	1	–	1	–	4	4	2	2	2	*100*	3+
S. herbacea × *polaris*	2	1	–	–	–	3	4	4	4	4	1	1	3	1	3		
Saussurea alpina	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	7	1
Saxifraga groenlandica	–	–	1	–	–	1	–	1	1	1	–	–	–	–	–	33	1
S. nivalis	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	7	1
S. oppositifolia	–	–	–	–	–	–	–	1	–	1	–	–	–	–	–	20	1
Sedum rosea	1	2	1	1	1	–	–	–	–	–	–	–	–	–	–	33	1
Silene acaulis	1	1	1	1	1	–	1	1	2	1	1	–	1	–	–	73	1
Stellaria crassipes v. *dovrensis*	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	13	1
Thalictrum alpinum (steril)...	–	–	–	–	–	1	1	1	1	1	–	–	–	–	–	33	1
Alectoria ochroleuca	4	5	5	4	5	5	4	4	5	5	4	5	5	5	5	*100*	5÷
A. nigricans	1	2	2	1	2	1	1	1	1	1	2	1	2	2	1	*100*	1+
Cornicularia divergens	2	2	3	2	2	2	2	2	2	2	3	2	2	1	2	*100*	2
Cetraria cucullata	2	1	1	2	2	2	1	1	2	2	2	2	2	2	2	*100*	2÷
C. nivalis	4	4	4	4	4	4	4	3	4	4	4	4	3	3	4	*100*	4÷
C. islandica coll.	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	*100*	1
Cladonia coccifera	1	1	1	1	1	1	1	1	1	1	1	–	–	–	–	73	1
Cl. gracilis	–	–	–	–	–	1	1	1	1	1	1	–	–	–	–	40	1
Cl. rangiferina	1	1	–	–	1	1	1	1	2	2	2	2	1	2	1	87	1+
Cl. silvatica (*mitis*)	2	1	1	1	2	1	2	1	2	2	2	2	2	3	2	*100*	2÷
Cl. uncialis	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	13	1
Cl. verticillata	–	–	1	1	1	–	–	–	–	–	–	–	–	–	–	20	1
Ochrolechia frigida	1	1	1	2	1	1	1	1	1	1	1	1	2	1	2	*100*	1

Bestandsnummer:	I					II					III					K%	D
Rutenummer:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
Parmelia saxatilis	1	2	1	–	–	1	1	–	1	–	1	1	1	1	–	67	1
Solorina crocea	–	1	1	–	–	–	–	–	1	–	–	–	–	–	–	20	1
Sphaerophorus globosus	2	1	2	2	2	1	1	1	1	1	1	1	2	1	2	*100*	1+
Stereocaulon paschale	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	*100*	1
Thamnolia vermicularis	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	*100*	1
Aulacomnium turgidum	–	–	–	–	–	–	1	–	1	–	–	–	1	–	–	20	1
Conostomum tetragonum	1	–	–	–	1	–	–	–	–	–	1	–	1	1	1	40	1
Dicranum fuscescens	–	–	1	–	1	1	2	1	1	1	1	1	1	1	2	80	1
Polytrichum juniperinum	2	3	2	3	3	1	1	1	1	1	2	3	3	2	2	*100*	2
P. piliferum	2	2	2	2	3	1	1	1	1	1	2	2	2	2	2	*100*	2÷
Rhacomitrium lanuginosum	1	1	–	–	–	1	1	–	1	2	–	–	–	–	1	47	1
Tetraplodon mnioides	–	–	–	–	–	–	–	–	1	1	–	–	–	–	–	13	1
Gymnomitrium corallioides	2	2	2	3	2	–	–	1	–	1	–	–	2	–	1	60	2÷
Microhepaticae	1	1	1	1	1	–	–	–	–	–	–	1	1	1	1	60	1
Antall karplanter på 1 m²	13	13	14	11	14	9	13	13	11	14	7	8	10	8	7		

praktfullt utviklede, men kortvoksne *Polygonum viviparum-Potentilla Crantzii-Silene acaulis*-enger med en matte av *Hylocomium splendens* og mange andre moser i bunnen. Jeg disponerer for disse engers vedkommende over et analysemateriale fra Knutshø bestående av 20 ruter à 4 m² fra 4 vakre bestand. I tre av bestandene var *Poa arctica* helt underordnet, men konstant på 4 m². I det fjerde bestand, som ligger i 1500–1550 m høyde i svak skråning mot sydvest, var *Poa arctica* ikke alene konstant, men viste her dekningsgraden III–IV pr. 4 m². Forat ikke tabellen skal bli altfor lang, skal jeg her bare gjengi analysene fra det sistnevnte bestand.

Alt i alt er det etter min erfaring en meget sjelden foreteelse å finne *Poa arctica* med så høy dekningsgrad som IV, og det analyserte bestand oppfatter jeg som en lokal *Poa arctica*-variant.

Dette bestand ble nederst i skråningen avløst av et fuktigere areal hvor *Hylocomium splendens* var ute av spillet, mens moser som *Distichium capillaceum* og *Oncophorus virens* sammen med *Nostoc* gjorde seg mest gjeldende i bunnen. Her dukket *Poa stricta* opp ved siden av *P. arctica*, og sammen med den innfant seg *Deschampsia alpina*, *Juncus biglumis* og *Stellaria crassipes* var. *dovrensis*. Lokaliteten var overmåte instruktiv: mens *Poa arctica* var herre og mester på det høyestliggende og tidligst snøbare areal, ble *Poa stricta* domi-

Tabell II. Polygonum viviparum - Potentilla Crantzii - Silene acaulis - Hylocomium splendens - soc. Nordre Knutshø, 1500–1600 m o. h. 12. august 1933.

Rutenummer (4 m²):	1	2	3	4	5	Rutenummer (4 m²):	1	2	3	4	5
Poa arctica (excl. *stricta*)	4	4	4	4	3	*Thalictrum alpinum*	2	2	2	3	2
P. alpina	3	4	3	2	1						
P. pratensis **alpigena*	–	1	1	–	–	*Aulacomnium turgidum*	3	2	1	2	3
Festuca vivipara	2	3	3	3	3	*Blindia acuta*	–	–	1	–	2
Trisetum spicatum	2	1	1	1	1	*Campylium stellatum*	–	2	1	–	–
Carex Lachenalii	–	–	1	–	–	*Climacium dendroides*	–	–	–	–	2
C. misandra	1	1	–	–	–	*Dicranum* sp.	3	2	3	1	2
Luzula spicata	1	1	1	2	1	*Drepanocladus uncinatus*	–	2	1	1	–
Cerastium alpinum	1	2	2	2	1	*Hylocomium splendens*	4	2	2	5	5
Draba alpina	2	1	1	1	2	*Hypnum callichroum*	1	1	1	1	2
Erigeron uniflorum	1	1	–	2	2	*Oncophorus virens*	1	1	2	1	–
Melandrium apetalum	1	–	–	–	–	*Polytrichum alpinum*	1	2	2	1	1
Minuartia biflora	–	–	1	1	1	*Rhytidium rugosum*	1	–	–	1	2
Petasites frigidus	1	1	1	1	–	*Tomentohypnum nitens*	2	1	1	2	2
Polygonum viviparum	4	3	3	3	3	*Ptilidium ciliare*	2	1	–	1	1
Potentilla Crantzii	2	1	1	1	3	*Cetraria cucullata*	1	–	–	1	1
Pedicularis Oederi	3	2	1	1	3	*C. nivalis*	–	–	–	1	1
Salix polaris	2	3	2	3	2	*Peltigera aphthosa*	1	1	1	1	2
Saxifraga groenlandica	1	–	–	–	–	*P. scabrosa*	–	–	–	1	–
S. oppositifolia	1	1	2	1	1	*Thamnolia vermicularis*	1	–	–	–	1
Saussurea alpina	1	1	2	2	2	*Nostoc* cfr. *commune*	1	1	1	–	–
Sedum rosea	1	1	2	2	2						
Silene acaulis	4	4	4	3	4	Antall karpl. pr. 4 m²	21	20	20	19	18

nant på snøleiet, og i dettes mest ekstreme parti helt enerådende. Det fantes imidlertid en overgangszone, hvor *Poa arctica* og *Poa stricta* var omtrent jevnbyrdige; men typisk nok: samtidig med *Poa stricta*'s opptreden på arenaen, innfant også *Deschampsia alpina* og *Juncus biglumis* seg. Også disse to arters individtetthet økte i retning mot det egentlige snøleie.

Jeg mener med disse eksempler å ha demonstrert at *Poa arctica* (**depauperata* og **elongata*) formår å gjøre seg gjeldende såvel på tørr som frisk mark. Arten synes dog å sky lokaliteter med sterk uttørring i vinterhalvåret, selv om den leilighetsvis også våger seg ut i Kobresieta myosuroidis.

La oss dernest se nærmere på *Poa stricta*'s opptreden. Denne er i Drivdalens fjell i sterkere grad enn *Poa arctica* bundet til høye ni-

Tabell III. Poa stricta - bestand fra platået på Store Nystuhø ca. 1560 m o. h. 16. august 1947.

Bestandsnummer:	I							II		
Rutenummer (1 m²):	1	2	3	4	5	6	7	8	9	10
Poa stricta	4	4	4	4	4	5	5	5	4	4
P. arctica	1	1	1	1	1	1	1	1	–	1
P. flexuosa	1	–	1	–	1	1	1	1	–	–
Deschampsia alpina	2	1	1	2	1	1	2	1	1	2
Festuca vivipara	2	2	2	2	2	2	1	1	2	1
Phippsia algida	–	–	–	–	–	1	1	1	1	1
Juncus biglumis	–	1	–	–	–	–	1	–	–	1
Eriophorum angustifolium (steril)	–	1	–	1	1	–	–	–	–	–
Cardamine bellidifolia	1	1	2	2	1	1	1	–	1	1
Cerastium alpinum	1	2	1	1	2	1	2	1	1	1
Koenigia islandica	2	2	2	2	2	1	1	1	2	2
Melandrium apetalum	1	–	–	–	–	–	–	1	–	–
Pedicularis Oederi	–	–	–	–	–	–	–	1	–	–
Polygonum viviparum	1	–	–	–	–	–	–	–	–	–
Ranunculus glacialis	1	1	–	–	–	1	–	1	–	1
Aulacomnium turgidum	–	–	1	–	–	1	–	1	1	1
Calliergon sarmentosum	–	1	1	2	3	1	–	–	1	1
Polytrichum alpinum	1	1	1	1	–	–	–	–	–	–
Naken sand og fint grus	5	5	5	5	4	4	4	4	5	5
Antall karplanter pr. 1 m²	11	10	8	8	9	10	10	11	7	10

våer, selv om dens yngleknopper nok leilighetsvis kan føres av bekker ned i den lavalpine, ja en sjelden gang ned i den subalpine region, hvor planten da opptrer på elvebredder (f. eks. ved Drivstua; jfr. NANNFELDT 1940 p. 15). For atskillige år siden gjorde min venn hotelleier PER HOLAKER, som er en utmerket amatørbotaniker og skarp iakttager, meg oppmerksom på at *Poa stricta* finnes i enorme masser i det forholdsvis flate terreng mellom de to høyeste topper på Store Nystuhø på Drivdalens vestside i 1500 til 1600 m.s høyde. Han hadde her på sine jaktturer i enkelte år sett mindre strekninger som ut på høsten var mørkt vinfarget av *Poa stricta*'s svaiende blomsterstander med de sprikende yngleknopper, et etter hans mening enestående vakkert syn. Den 16. august 1947 foretok jeg en ekskursjon til det anviste fjellparti, og jeg ble ikke skuffet! Ovenfor har jeg laget en tabell over 10 ruteanalyser fra den mest frapperende

strekning. De 7 første ruter skriver seg fra et stort bestand som lå i svak skråning mot syd i ca. 1560 m.s høyde omtrent midtveis mellom de to topper (1754 m og 1683 m) som utmerker Store Nystuhø. De 3 siste ruter er tatt fra et mindre bestand i 1568 m.s høyde i flatt terreng, bare noen få hundre meter nordenfor det første bestand. Lokalitetene må betegnes som snøleier; men de er i snøsmeltningstiden utsatt for svak erosjon i overflaten, derfor er bunnkryptogamene så dårlig utviklet.

Karakteristisk for disse bevoksninger er kombinasjonen *Poa stricta* + *Deschampsia alpina* + *Festuca vivipara* + *Koenigia islandica*, dessuten den spredte forekomst av hygrofytter som *Phippsia algida*, *Juncus biglumis*, *Eriophorum angustifolium* og *Calliergon sarmentosum*. I august 1947 var bestandene helt uttørket; men dette var jo en ekstremt tørr sommer. Normalt er gruset vannholdig også i august måned selv etter at snøfonnene i nærheten er smeltet vekk. Det synes også å være utsatt for svak jordflytning og oppfrysning.

På Knutshø opptrer *Poa stricta* liksom på Nystuhø bare i snørike forsenkninger eller på slake skråninger som lenge utover sommeren er utsatt for overrisling med henholdsvis snøvann eller grunnvann som siger fram fra flytjordsgrus. Bestandene treffes ofte midt på eller i randen av svake solifluksjonsterrasser. Da de tørre arealer i Knutshø-massivet helt og holdent domineres av ytterst lavrike samfunn som på avstand virker lysgrå eller gulgrå, mens de fuktigere partier i vesentlig grad beherskes av moser, virker disse siste på avstand brunlige. De norske botanikere som kjenner Drivdalsfjellene og deres rike flora, vet at skal man prøve å finne slike sjeldenheter som *Poa stricta*, *Stellaria crassipes* v. *dovrensis*, *Sagina caespitosa* og *Luzula arctica*, må man utelukkende holde seg til »de brune striper».

I nedenstående tabell har jeg stilt sammen 20 ruteanalyser à 1 m^2 fra 5 forskjellige lokaliteter av denne type (bestand nr. I og II er fra Nordre Knutshø i nordskråning ca. 1500 m o. h.; nr. III er fra Midtre Knutshø i omtrent samme høyde i vestskråning; nr. IV er fra Nordre Knutshø og fra det sted hvor jeg selv første gang fant *Stellaria crassipes* v. *dovrensis*; lokaliteten ligger i svak sydskråning mellom Sprenbekken og toppen av N. Knutshø ca. 1550 m o. h.; nr. V er hentet fra Søndre Knutshø i ca. 1450 m.s høyde og i svak vestskråning). I alle fem bestand såes spor etter solifluksjon, oppfrysning og svak vannerosjon i overflaten. I regnværsperioder og i snøsmeltningstiden i juni–juli er lokalitetene temmelig oppbløtt. Undergrun-

nen er over hele linjen morenegrus med større og mindre steiner som stikker opp av planteteppet (jfr. »nakent grus og stein» sist i tabellen).

Analysene er i virkeligheten utført for å klarlegge det botaniske miljø hvori den merkelige *Stellaria crassipes* var. *dovrensis* opptrer; men de kan i like høy grad tjene til belysning av *Poa stricta*'s økologi.

Av tabellen ser man at artstettheten pr. 1 m² i bestand I–III varierer mellom 25 og 32 bare for karplanter. Dette torde være noe av en rekord, særlig i betraktning av den store høyde over havet. (På Knutshø har jeg ellers bare én eneste analyseserie som viser høyere artstetthet pr. 1 m², nemlig 33–40; men det dreier seg om en sekundært oppstått *Agrostis tenuis*-eng i en bakke nær Kongsvoll fjellstue, fremgått ved degradasjon av *Salix myrsinites*-kratt etter flere mannsaldrers intens beitning. Angående artstettheten i Agrostetum tenuis subalpinum jfr. Nordhagen 1943 p. 398–402.) — Ellers inneholder disse bestand en unik samling av interessante høyfjellsplanter (*Poa stricta, Poa arctica, Carex misandra, Draba alpina, Koenigia islandica, Melandrium apetalum, Minuartia stricta, Sagina caespitosa, Stellaria crassipes* v. *dovrensis* o. fl.).

Nannfeldt har i sin avhandling av 1940 publisert 3 ruteanalyser à 4 m² fra et av meg analysert bestand i 1600–1620 meters høyde på Nordre Knutshø med rikelig *Poa stricta*. Som en foreløpig foranstaltning ga jeg denne vegetasjonstype navnet *Poa stricta-Deschampsia alpina-Oncophorus virens*-sociasjon. Nannfeldt har videre publisert 8 ruteanalyser à 1 m² fra to andre bestand i 1400–1500 m høyde på Nordre Knutshø med rikelig til dekkende *Carex misandra*. Denne vegetasjonstype ga jeg det foreløpige navn *Carex misandra-Drepanocladus intermedius-Blindia acuta*-sociasjon. Her viste *Poa stricta* en dekningsgrad fra II til III.

Den nedenfor publiserte tabell viser oss en beslektet samfunnstype; i det hele tatt er overensstemmelsen mellom tabell 1 og 2 hos Nannfeldt 1940 (p. 16–17) og nedenstående nye tabell på mange måter slående. Allerede i en avhandling fra 1936 har jeg ganske kort omtalt disse merkelige mellomalpine samfunn under overskriften »Schneebodenähnliche Gesellschaften auf feuchtem, kalkreichem Schutt». Jeg uttaler her: »Meine diesbezüglichen Aufnahmen aus den Gebirgen Peldsa, Alap, Tausa und Knutshø deuten entschieden darauf, dass sich ein eigener Verband (etwa „Luzulion nivalis") austrennen lässt, der höchstwahrscheinlich ein Analogon des mittel-

Tabell IV. Analyser fra fem bestand av *Poa stricta - Stellaria crassipes* - sociasjon på Knutshøene. Bestand I–IV undersøkt 29. juli 1946, bestand V 21. juli samme år.

Bestandsnummer:	I				II						III		IV				V			
Rutenummer (1 m²):	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Poa stricta	1	1	1	–	–	1	1	–	1	1	2	1	2	2	3	2	2	2	2	2
P. arctica	2	2	2	1	1	2	2	1	1	1	1	–	1	1	1	1	–	–	–	–
P. alpina f. *vivipara*	1	–	1	–	–	–	–	–	–	–	1	1	–	1	1	–	1	1	1	1
P. alpigena	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1	2	–	1
P. flexuosa	1	–	–	–	1	1	1	1	1	1	–	–	–	–	–	–	–	–	–	–
Deschampsia alpina	1	–	–	1	2	1	1	2	–	2	1	2	1	1	1	1	2	2	1	2
Festuca vivipara	3	3	2	2	3	2	3	1	1	3	2	2	3	3	3	3	1	1	3	1
Phippsia algida	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–
Trisetum spicatum	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	–	1	1	–	1
Carex Bigelowii	1	2	1	1	2	2	1	1	1	1	–	1	3	1	2	1	–	–	–	–
C. Lachenalii	–	–	–	–	–	–	–	–	–	–	2	1	–	–	–	–	2	2	–	1
C. misandra	2	1	1	2	2	1	2	1	1	1	1	2	–	–	–	–	–	–	–	–
C. saxatilis	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Eriophorum angustifolium	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	2	1	–	–
E. Scheuchzeri	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Juncus biglumis	–	–	–	1	–	1	–	1	1	1	1	1	1	1	1	1	2	2	2	2
J. triglumis	–	1	1	1	–	1	1	1	1	1	–	–	–	–	–	–	–	–	–	–
Luzula arcuata coll.	1	–	–	1	1	1	1	1	1	1	–	–	–	1	1	–	–	–	–	–
L. spicata	3	1	2	2	1	1	1	2	2	1	1	2	2	2	2	2	1	1	2	1
Cardamine bellidifolia	1	1	1	–	1	1	1	1	1	1	1	1	1	1	1	1	1	–	–	–
Cerastium alpinum	2	1	1	1	1	1	2	1	1	1	1	1	2	2	1	2	1	1	2	1
C. cerastoides	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
Draba alpina	2	2	3	2	2	3	2	2	1	1	1	2	2	1	1	1	1	1	1	1
Equisetum arvense v. *alpestre*	1	1	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Erigeron uniflorum	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–
Koenigia islandica	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Melandrium apetalum	1	2	2	3	1	1	1	1	1	1	1	1	1	1	1	1	–	–	1	–
Minuartia biflora	1	–	–	–	–	–	–	–	–	–	1	1	–	–	–	–	1	–	–	–
M. stricta	–	–	–	–	1	1	–	1	–	–	1	1	1	1	–	1	1	–	1	1
Oxyria digyna	1	–	–	–	1	1	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Papaver radicatum **ovatilobum*	2	–	–	–	–	1	1	2	–	1	–	–	–	–	–	–	–	–	–	–
Pedicularis Oederi	2	1	1	1	1	1	1	1	1	1	–	1	1	1	–	1	–	–	1	–
Petasites frigidus	–	–	1	2	–	–	–	–	–	–	–	–	1	2	1	1	1	1	–	2
Polygonum viviparum	3	3	3	2	2	2	3	3	2	2	2	2	3	2	3	3	2	2	2	1
Potentilla Crantzii	–	–	–	–	–	–	1	–	–	–	–	–	1	–	–	–	–	–	–	–
Ranunculus glacialis	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R. pygmaeus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–
Sagina caespitosa	2	1	–	–	1	1	1	1	1	–	–	–	1	1	1	1	–	–	1	1
S. intermedia	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	1	1

Bestandsnummer:	I				II						III		IV				V			
Rutenummer (1 m²):	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Salix herbacea	–	–	–	–	–	–	–	–	–	–	1	1	2	1	–	–	–	–	–	–
S. herbacea × *polaris*	–	–	–	–	–	–	–	–	–	–	2	3	2	2	3	1	2	2	2	3
Saussurea alpina (steril)	–	–	–	–	–	–	1	–	1	–	1	1	–	–	–	–	–	–	–	–
Saxifraga cernua	1	1	–	1	1	1	1	1	1	1	–	–	1	1	1	1	1	1	1	1
S. groenlandica	–	–	–	–	1	–	1	1	1	–	–	1	1	1	1	1	–	–	–	–
S. oppositifolia	2	2	1	2	2	1	1	2	2	1	1	1	3	2	3	3	1	1	4	2
S. tenuis	1	–	1	–	1	1	–	–	–	–	–	–	1	1	–	–	–	1	–	–
Sedum rosea	2	1	1	1	1	1	1	1	1	1	–	1	–	1	1	–	–	–	1	–
Silene acaulis	3	2	1	3	2	2	3	3	3	2	1	1	1	2	2	2	–	–	1	–
Stellaria crassipes v. *dovrensis*	1	2	1	2	2	2	2	2	1	2	2	2	1	2	1	1	2	1	1	2
Taraxacum dovrense	1	1	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Thalictrum alpinum	2	2	3	2	1	1	3	1	2	1	1	1	2	1	–	–	–	–	1	–
Aulacomnium turgidum	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1	–	–	–	1	–
Blindia acuta	2	3	3	2	2	3	3	4	3	3	2	1	2	2	1	1	–	–	–	–
Brachythecium glareosum	–	–	–	–	–	–	–	–	–	–	1	–	1	2	1	1	1	1	1	1
Calliergon turgescens	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	–	1	–	–
Campylium stellatum	2	2	3	2	2	2	2	1	1	1	1	1	1	1	1	1	–	1	1	1
Distichium capillaceum	2	2	1	1	2	2	1	2	2	2	3	4	2	2	3	3	3	3	3	3
Drepanocladus intermedius	3	3	3	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	1	1
Hylocomium splendens	–	–	–	–	–	–	–	–	–	–	1	1	–	1	–	–	–	–	1	–
Hypnum callichroum	–	–	–	–	–	–	–	–	–	–	1	1	1	–	–	–	–	–	–	–
Myurella tenerrima	1	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Philonotis tomentella	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	1	1
Tomentohypnum nitens	–	–	–	–	–	–	–	–	–	–	1	1	1	1	1	1	–	–	–	–
Tortella tortuosa	2	2	2	2	1	–	1	–	1	1	1	1	1	1	1	1	2	1	1	1
Webera commutata	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	2	2	1	1
Cetraria islandica	–	–	–	–	–	–	–	–	–	–	1	1	1	1	1	1	–	–	1	1
C. nivalis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	+	–	–	–	–
Cladonia pyxidata	–	–	–	–	–	–	–	–	–	–	–	–	1	1	1	1	–	–	–	1
Cl. verticillata	–	–	–	–	–	–	–	–	–	–	1	1	1	1	1	1	–	–	1	1
Lecidea sp.	1	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Ochrolechia frigida	1	1	1	1	1	–	–	–	1	1	1	–	–	–	–	–	–	–	–	–
Pertusaria sp.	1	–	–	–	–	1	–	–	1	–	1	–	–	–	–	–	2	1	2	1
Stereocaulon cfr. *alpinum*	–	–	–	–	–	1	–	–	2	1	–	–	1	1	1	–	–	–	1	–
Thamnolia vermicularis	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–
Nostoc cfr. *commune*	1	1	2	1	1	2	1	2	1	2	2	2	2	3	2	1	–	–	–	–
Nakent grus og stein	3	4	3	3	3	3	3	4	3	3	4	3	4	4	3	3	3	3	2	2
Antall karplanter pr. 1 m²	32	25	27	28	28	31	30	29	28	28	27	30	31	30	26	25	22	22	25	22

europäischen Verbandes „Arabidion coeruleae" (vgl. Braun-Blanquet 1926 und Jenny-Lips 1930) vorstellt.» Samtidig har jeg fremhevet at denne gruppe i Norden inntar en merkelig mellomstilling mellom de forbund som jeg i 1936 kalte »Potentilleto-Polygonion vivipari», »Caricion bicoloris-atrofuscae» og »Ranunculeto-Oxyrion». I 1939 har jeg i »Bidrag til fjellet Pältsa's flora» publisert 3 ruteanalyser fra en *Stellaria longipes* (*crassipes*)-forekomst på Pältsas nordside i 1050–1150 m høyde. Også disse ruter viser en umiskjennelig overensstemmelse med de ovenfor diskuterte plantesamfunn, selv om materialet på grunn av forekomstens lokale natur er meget knapt. — Da navnet *Luzula nivalis* nå har måttet vike plassen for *Luzula arctica* Blytt, må vedkommende forbund kalles Luzulion arcticae. Hvor mange assosiasjoner og sociasjoner dette forbund i fremtiden kommer til å bli delt i, er foreløpig uvisst. Jeg beklager at jeg ikke tidligere har hatt anledning til å publisere ovenstående tabeller fra Dovre. — I 1950 ga Olav Gjærevoll en oversikt over snøleiesamfunnene i Torneträsk-området, og han har her tatt opp det av meg foreslåtte gruppenavn Luzulion arcticae (= nivalis) i samband med publikasjonen av en tabell omfattende 26 kvadratanalyser à 1 m² fra 3 bestand på Nissontjårro. Av disse har det ene konstant *Stellaria crassipes*, det andre konstant *Sagina caespitosa*, det tredje konstant *Luzula arctica*. Ellers er overensstemmelsen mellom denne Gjærevolls tabell XX og ovenstående tabell IV fra Knutshø på mange måter frapperende (jfr. den høye K % for *Deschampsia alpina, Festuca vivipara, Juncus biglumis, Poa arctica, Melandrium apetalum, Sagina caespitosa, Campylium stellatum* o. fl. arter i begge tabeller). Det er tenkbart at forbundet — trass i sociasjonenes overgripende natur — helst bør deles i 2 associasjoner: Luzuleto-Caricetum misandrae og Saginetum caespitosae (for den førstnevntes vedkommende se min tabell hos Nannfeldt 1940 p. 17 og Gjærevoll 1950 p. 436, rute 1–7). Det er en meget vanskelig oppgave å skape treffende plantesociologiske navn i det foreliggende tilfelle på grunn av det store antall arter og konstanter pr. 1 m². Før jeg forlater dette kapitel, som ligger noe på siden av mitt emne, vil jeg presentere en liten tabell som ytterligere kan belyse Luzuleto-Caricetum misandrae. Denne type opptrer i Knutshø-området bare i høye nivåer i den mellomalpine region og bare innenfor »de brune striper»; men den synes å foretrekke noe tørrere og mer stabilt morenegrus enn Saginetum caespitosae. Nedenfor finnes 3 ruteanalyser à 1 m² fra nordskråningen av Nordre

Tabell V. Luzula arctica - Carex misandra - Drepanocladus intermedius - sociasjon. Nordre Knutshø, 26. juli 1946.

Rutenummer (1 m²):	1	2	3	Rutenummer (1 m²):	1	2	3
Luzula arctica	2	2	2	*Aulacomnium turgidum*	1	1	1
L. arcuata coll.	1	1	1	*Calliergon sarmentosum*	2	1	2
Carex misandra	1	1	1	*Campylium stellatum*	1	1	4
Cerastium alpinum	1	2	2	*Conostomum tetragonum*	1	1	1
Draba alpina	2	2	1	*Distichium capillaceum*	1	1	1
Melandrium apetalum	1	–	–	*Drepanocladus intermedius*	5	5	3
Minuartia stricta	–	–	1	*D. uncinatus*	1	1	–
Pedicularis Oederi	1	1	1	*Myurella tenerrima*	–	–	1
Polygonum viviparum	1	1	1	*Philonotis tomentella*	–	1	1
Sagina caespitosa	–	1	1	*Tortella tortuosa*	1	2	1
Salix polaris	1	2	1	*Blepharostoma trichophyllum*	2	3	2
S. reticulata	1	1	1	*Cephalozia* sp.	1	1	1
Saxifraga oppositifolia	2	2	2	*Riccardia pinguis*	1	1	–
S. tenuis	–	1	–	*Scapania paludicola*	–	1	1
Silene acaulis	1	1	2	*Thamnolia vermicularis*	–	–	1
				Nostoc sp.	1	–	–
(Oppragende steiner)	3	3	2	Antall karplanter pr. 1 m².	12	14	14

Knutshø i ca. 1400 m.s høyde. Meget vakre bestand finnes ellers i østskråningen av Midtre Knutshø i 1500–1550 m.s høyde. *Luzula arctica* har imidlertid bare en svak bestanddannende evne i motsetning til *Carex misandra*. Når jeg har laget associasjonsnavnet Luzuleto-Caricetum misandrae i dette tilfelle, er det fordi *Carex misandra* i det centrale Norge også opptrer i *Carex atrofusca*- og *Kobresia simpliciuscula*-grasmyrer (»rikkärr» etter svensk terminologi) tilhørende forbundet Caricion atrofuscae-saxatilis (Nordhagen 1943 p. 455), men som en underordnet bestanddel.

Som ± gode ledearter for Luzulion nivalis tror jeg man kan utskille *Luzula nivalis, Poa stricta, Stellaria crassipes* og *Sagina caespitosa*, kanskje også *Draba crassifolia* (jfr. Nordhagen 1939 p. 694). Disse 5 arter er lite konkurransedyktige i forhold til de mange urter og gras som utmerker våre lavvoksne eutrofe høyfjellsenger og våre vanlige eutrofe snøleier. De klarer bare å gjøre seg gjeldende under helt spesielle økologiske forhold: baserik undergrunn, svak solifluksjon, tilgang på bevegelig vann iallfall under en del av vegetasjonsperioden, stor høyde over havet (som betinger frafall av en rekke farlige medkonkurrenter!), langvarig, men ikke ekstremt lang-

varig snøbedekning, og tilsvarande sen fremsmeltning på forsommeren.

Da dette ikke er tenkt som noen plantesociologisk avhandling, skal jeg her nøye meg med disse bemerkninger. Hovedsaken for meg har vært å vise følgende:

1) *Poa stricta* Lindeberg har en annen og langt snevrere økologisk amplitude enn de to i Sør-Norge representerte underarter av *Poa arctica* (**depauperata* og **elongata*).

2) *Poa stricta* må karakteriseres som en hygrofil, chionofil, eutrof og utpreget mikroterm planteart, som bare har evne til å gjøre seg gjeldende i store høyder over havet på svakt solifluksjonspreget, ikke altfor grovt morenemateriale. Til dens mest trofaste ledsagere hører *Koenigia islandica, Deschampsia alpina* og *Sagina caespitosa.* Av andre hygrofytter som pleier å opptre sammen med *Poa stricta* kan nevnes: *Juncus biglumis, Minuartia stricta, Stellaria crassipes, Campylium stellatum, Drepanocladus intermedius, Calliergon turgescens, Blindia acuta* og *Aulacomnium turgidum.*

3) *Poa arctica* (i Sør-Norge **depauperata* og **elongata*) har en helt annen økologisk amplitude. Den opptrer over store arealer som konstant i mellomalpin tørrbunnsvegetasjon f. eks. i grasheier med tette lavtepper i bunnen, dessuten i *Dryas*-heier, videre i kortvoksne mesofile *Polygonum viviparum - Potentilla Crantzii - Silene acaulis* - enger med *Hylocomium splendens* som dominerende mose i bunnen. Her kan *Poa arctica* stundom oppnå dekningsgraden IV. Av *Poa stricta* finner man i de nettopp nevnte xerofile og mesofile samfunn intet spor. — *Poa arctica* har imidlertid evne til å trenge inn i de samme hygrofile–chionofile samfunn som *Poa stricta*; men den gjør seg her lite gjeldende, og i de bestand hvor *Poa stricta* åpenbart har sitt økologiske optimum, er *Poa arctica* svakt representert eller den mangler helt (jfr. tabell IV, rute nr. 13–20, og Nannfeldt 1940 p. 16, rute nr. 1–3, og p. 17, rute nr. 5–8).

Da *Poa stricta* har kromosomtallet 2n = 38–39, mens *Poa arctica* **depauperata* har 2n = ca. 75 og **elongata* har 2n = ca. 68, 70, 72, 76, kan den ikke oppfattes som en hygrofil økotype av *Poa arctica*, så meget mer som den er obligat vivipar.

Poa stricta kan qua taxon ikke sammenlignes med f. eks. de fire subspecies av *Poa pratensis* L. som gjerne oppføres i nyere nordiske floraer (**angustifolia* [L.] Lindb., **eupratensis* Hiit., **irrigata*

[Lindm.] Lindb. og **alpigena* [Fr.] Hiit.). Som fremhevet av Hylander omfatter *Poa pratensis* utallige former, som »schematiskt» kan fordeles på de ovenfor nevnte fire grupper. Disse er nemlig »ej i något hänseende skarpt skilda» (1953 p. 256).

Poa stricta er som påpekt av Nannfeldt (1940 p. 20) »very different from the two non-viviparous Dovre races (of *Poa arctica*) and cannot possibly have arisen from any of them either». Nannfeldt uttaler ellers bl. a.: »*Poa stricta* has also many features common with the West-Arctic **caespitans* . . ., but is too different to be regarded as a viviparous form of it. They have also different chromosome numbers.»

Et godt kriterium på at et taxon, som ellers fremtrer som distinkt i morfologisk og cytologisk henseende, er eller bør oppfattes som en art (species), er økologisk selvstendighet. Dette er i høyeste grad tilfelle med *Poa stricta*.

Særlig i Hylanders nye flora har *Poa stricta* vært utsatt for en taxonomisk »devaluering» som ikke harmonerer med den høye rang han har gitt andre, etter min mening langt mer kritiske taxa. — Hylander opererer også med en *Deschampsia flexuosa* var. *montana* (L.) Gremli, og *Poa stricta* skulle da, qua varietet i Hylanders mening, sidestilles med denne på den taxonomiske rangstige. Imidlertid vil enhver som har hatt anledning til å foreta vegetasjonsanalyser fra barskogsregionens øvre del gjennom den subalpine og opp til den mellomalpine region, sikkert være enig med meg når jeg karakteriserer *Deschampsia flexuosa* var. *montana* som et ytterst svakt taxon. Ved transplantasjon fra Hardangervidda til Bergen antok denne type et utseende som minnet sterkt om lavlandstypen av *D. flexuosa* (jfr. Nordhagen 1943 p. 157, fig. 43 med forklaring).

For meg fortoner *Poa stricta* versus *P. arctica* seg som minst likså god som *Festuca vivipara* versus *F. ovina*; som *Agrostis gigantea* versus *A. stolonifera*, *Bromus ramosus* versus *B. Benekeni*, *Glyceria declinata* versus *G. fluitans*, og *Juncus ranarius* versus *J. bufonius*, for bare å nevne noen få aktuelle eksempler. — *Poa stricta*'s geografiske utbredelse er spesifik og dekker ikke det areal som utmerker *Poa arctica* **depauperata* henholdsvis **elongata*. *Poa stricta* kan ikke ha utviklet seg av noen av disse taxa; dens opprinnelse er foreløpig en gåte.

Botanisk Museum, Oslo i januar 1954.

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DEN ENDA SÄKRA VÄXTPLATSEN FÖR KOBRESIA SIMPLICIUSCULA (WAHLENB.) MACK. I FENNOSCANDIA ORIENTALIS.

AV

MAUNO J. KOTILAINEN.

Förekomsten av *Kobresia simpliciuscula* i östra Fennoskandien har i över hundra år spökat i den nordiska litteraturen. Så uppger redan E. Fries (1845, p. 74) den från »Lapponia» utanför »Suecia». Uppgiften preciseras av Andersson (1849, p. 15), som anger arten från Finmarken, »Perlevaag» och »från ryska Lappmarken». Synbarligen påverkad av Anderssons uppgifter har även Fellman (1882, p. 82) berett plats för sävstarren »in Lapponia Rossica».

Enligt Rune (1949, p. 442, på basen av Gjærevolls uppgifter) gives det i norska museer beläggexemplar av Deinboll utan namngiven ort från Finmarken. Varken Dahl (1934), Nordhagen (1940), Lid (1944) eller Hultén (1950) upptager dock arten från Finmarken, synbarligen på den grund, att det i Deinbolls samlingar säkerligen finns en del exemplar med s.k. »etikettförväxlingar».

Man frågar sig, varifrån Anderssons uppgifter »Perlevaag» och »ryska Lappmarken» härstammar. Det är för mig naturligtvis en omöjlighet att leta fram den rätta orsaken. Måhända kan spåren leda till Deinboll. När Andersson utgav sitt betydande arbete, var Deinboll 66 år gammal; han hade 25 år tidigare återvänt från sin verksamhet som sognepräst i östra Finmarken, men hade dessförinnan bl.a. gjort en exkursion år 1820 till Ryska Lappmarken, dvs. till Petsamo och längs kusten till Kola. Och i hans samling Flora lapponica finns växter tagna i Berlevåg 1822 (Dahl 1934, p. 24). Varpå Anderssons skrivfel »Perlevaag» i stället för Berlevaag beror, kan jag icke bedöma. På grund av personligt samtal eller skrivfel även av den danskfödde Deinboll? Frågan om

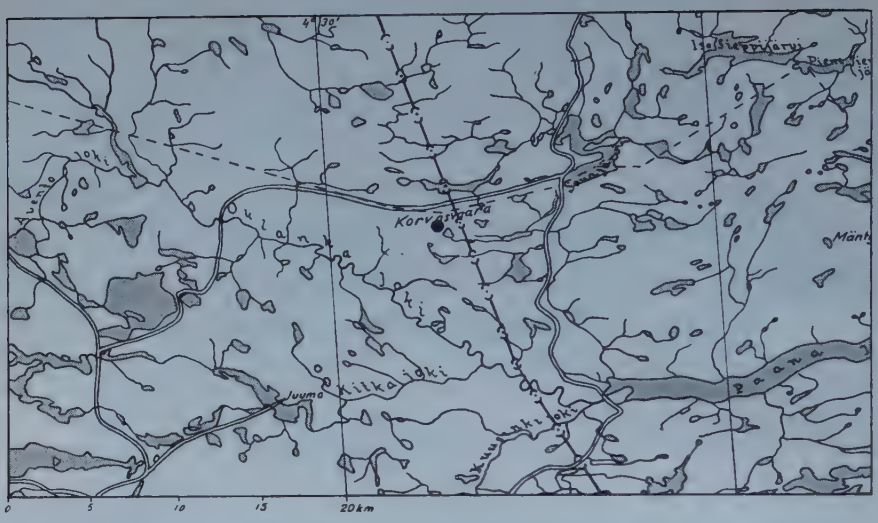

Fig. 1. *Kobresia simpliciuscula* (Wahlenb.) Mack. i Kuusamo.

Kobresia simpliciuscula's säkra förekomst i Finmarken och i Ryska Lappmarken måste således också från min sida lämnas öppen.

Denna artens förmenta utbredning utanför Skanderna har dock redan för 17 år sedan åtminstone i ett fall förvandlats till en reell förekomst, då det förunnades mig att upptäcka arten den 16 juli 1936 på Korvasvaaras södra sluttning i Kuusamo socken i Liikasenvaara by helt nära sockengränsen till Salla och endast ca 2 km väster om Finlands nya riksgräns; jfr fig. 1 och Hulténs karta 315 (1950).

Då beträffande fyndet endast ett kort meddelande (Kotilainen 1936–1938, p. 92; Rune 1949, p. 442) och en populär uppsats (Kotilainen 1947) föreligger, synes det mig vara motiverat att något utförligare avhandla artens förekomst och om själva fyndet lämna några detaljer, som icke ens saknar nära nog »dramatiska» poänger.

I juli 1936 befann jag mig i Kuusamo på tjänsteresa med uppgift bl. a. att hålla föredrag om myrodlingens möjligheter i trakten. En enda dag, den 16 juli, kunde jag disponera för en floristisk exkursion. Jag startade från Käylänkoski vid Kitkajoki i den arla morgonstunden i sällskap med agronomen T. Korhonen; vi strövade först omkring på stränderna av Purkuputaanköngäs norr om Oulankajoki, fann på dolomitklipporna några sällsynta mossor, beundrade på

avsatserna bl. a. *Helleborine atrorubens* och *Polygala Amarella*. Fanerogamrariteterna var redan tidigare kända genom Pesolas (1918) omfattande exkursioner, men några av mossorna var nya för lokalen. Andra etappen gällde en liten tjärn — Tulilampi — strax söder om landsvägen till Liikasenvaara. Jag erinrar mig icke mera, vad som föranledde besöket vid tjärnens försumpade stränder. I min notisbok hade jag skrivit bl. a.: »... *Carex Oederi* — 2 muotoa» (= två former). Den ena formen döptes sedermera till *Carex Kotilaini* Palmgr. (Palmgren 1944). Den är numera känd från tre skilda fyndplatser (Kotilainen 1951, p. 77 och 112). I ovetskap om formens värde kunde jag ej känna upptäckarens vanliga och saliga glädjerus vid ett »jättefynd».

På eftermiddagen nåddes Korvasvaara, dit vi styrde kosan på uppmaning av fil. dr R. Krogerus. Han hade på sina koleopteroekologiska exkursioner nedanom Korvasvaaras sydsluttning, ca 2 km från landsvägen, funnit *Schoenus ferrugineus*, vid denna tid ännu en Kuusamo-raritet (Sonck 1937, p. 128–129, och Kotilainen 1951, p. 100). Min förmodan att axagen kunde ha ett acceptabelt följe visade sig också ganska riktig.

Redan hungriga och trötta anträdde vi vandringen neråt i sydlig riktning i den skuggiga och fuktiga granskogen. Inte ens upptäckten av bl. a. *Cystopteris montana* (ställvis cpp), *Cypripedium*, *Actaea erythrocarpa*, *Fragaria vesca* och *Epilobium davuricum* kunde uppliva de trötta lemmarna i den tilltagande skymningen. Och i min — då ännu icke av krigen »tärda» — frodiga kroppshydda började alla lasters moder — lättjan — göra sitt intåg. Men tack vare min resolute kamrat gjorde jag dock icke helt om. Och just då började på något avstånd i den täta granskogen skymta tallar, som bildade bården till ett rikkärr och där bortom lyste någonting gult vid en sprudlande källa. Ingen tvekan mer: den gula färgen måste härröra från ett större *Saxifraga aizoides*-bestånd. Trötthetens var med ens bortblåst!

Ivrigt började vi undersöka källbäcken med dess rika tillflöde av kallt vatten. De tjocka *Cratoneuron*-mattorna ävensom *Equisetum scirpoides*, *Carex capitata*, *C. capillaris*, *Salix reticulata* var säkra kalkindikatorer. Därtill *Juncus triglumis*, för mig en ny Kuusamobekantskap. Arten förekommer i Kuusamo endast i dessa trakter, inklusive Paanajärvi-trakten, där artens kända sydgräns gick ända till år 1952, då jag fann en disjunkt förekomst ca 160 km åt SW i Puolanka (Ok), Lylykylä, vid Uutelanvaara i ett kalkkärr med bl. a. *Philonotis calcarea*; denna växte även vid källdraget på Korvasvaara

Fig. 2. Där källbäcken på Korvasvaara forsar fram till det nästan öppna rikkärret. — Foto Esko och Paavo Suomalainen 17.7. 1937.

tillsammans med *J. triglumis*. Ditintills (1936, 1952) var mossan känd endast från landskapen Al och Kl.

Men sockret på bottnen! Där källbäcken på Korvasvaara forsar fram till det nästan öppna rikkärret (jfr fig. 2) sågs först några enstaka, sedan tiotals besynnerliga tuvor, som sträckte sig längs bäckens ränder ända ned till en liten tjärn mellan Ylä Kuivajärvi sjö och Vanhalampi tjärn. Vid den första åsynen av tuvorna blev jag orörlig som en »Vorsteher» inför bytet, och i precis samma ställning fann jag 12 år senare vännen Rune vid den första tuvan. Min första tanke (1936) var, att jag hade *Carex Lachenalii* framför mig. Någon-

Fig. 3. *Kobresia simpliciuscula* tillsammans med *Carex jemtlandica* och *Saxifraga aizoides* vid randen av källbäcken på Korvasvaara. — Foto Esko och Paavo Suomalainen 17.7. 1937.

ting i tuvornas habitus bidrog dock till att luppen drogs fram, och då kände jag den allom bekanta saliga skälvningen, som belönar upptäckaren. Växten saknade ju helt och hållet fruktgömmen, som ersattes av två små skärmblad! Då måste den ju tillhöra släktet *Kobresia* och inte *Carex*! Men vilken art? *Kobresia myosuroides*, som jag ju själv hade sett i Norge, kunde det inte vara; det måste vara *K. simpliciuscula*, som jag aldrig tidigare hade sett i naturen.

Skandernas bergsklättare må icke ringakta mig! Ty både Lid (1944, p. 126) och Hegi framhåller, att sävstarren liknar ripstarren, och det gör den ju i alla fall, men de sega tuvorna har även något gemensamt med staggbladen.

Utan att höra till den inre ringen av skarpögda växtkännare har

jag på mina många exkursioner haft en god tur. Så även i detta fall. Hade vi icke råkat komma just till den rätta källbäcken, skulle arten måhända ännu i denna dag slumra i sitt ide, ty på samma sluttning finns flera källådror samt därtill ett par andra bäckar, som hyser precis samma nordliga arter — utom *Kobresia simpliciuscula*. Även följande sommar (1937) blev trakten noga finkammad av en större expedition från Vanamo-sällskapet. Vi gjorde många fina fynd, nya lokaler för t. ex. *Juncus triglumis* och *Saxifraga aizoides* upptäcktes, men varken då eller senare har någon ny *Kobresia*-bäck påträffats.

Sommaren 1948 besökte jag, efter elva händelserika år, åter Korvasvaara, denna gång i sällskap med fil. lic. O. Rune, med. stud. U. Söderberg och fil. mag. J. Lounamaa. Vi irrade oss i hällregnet in i ett taggtrådsstängsel, som hade anlagts nära den nya riksgränsen för att hindra boskapen från att överskrida »järnridån». Vi fann många källdrag, men det riktiga först efter ett par timmars sökande. Under letandet tyckte jag mig få några frågande ögonkast från vännen Rune. Jag kunde mycket väl förstå, att för en erfaren fjällklättrare tanken att finna sävstarren i en tallmyr, således i barrskogsregionen, tedde sig som någonting absurt. Men det var just Rune, som lyckades upptäcka den första tuvan, och därmed var min ära räddad.

Trots fridlysningen har beståndet något beskattats; men då växtplatsen ligger så pass avskilt, hoppas jag att det tämligen stora beståndet kommer att fortleva på Korvasvaara.

Vid upptäckten 1936 glömde jag till en början totalt bort *Schoenus ferrugineus*. Arten hade nu degraderats till ett objekt av andra klass. Men efter det jag hämtat mig något, hittades också den och därtill även andra arter, såsom *Carex jemtlandica*. En fullständig artlista synes mig här överflödig, då i min studie över meso-eutrofa kärrarter (1951, p. 73–84) 46 arter upptagits från undersökningsområdet Kuusamo n:o 79, som avser *Kobresia*-lokalen.

Kobresia simpliciuscula-tuvorna inskränka sig nästan undantagslöst till randen av den beskrivna källbäcken (jfr fig. 3) och i huvudsak till den övre delen av bäckfåran, som genom torven skurit sig ganska djupt in i mineraljorden, men arten förekommer med avtagande ymnighet även på torvgrund bort mot den lilla tjärnen. Däremot saknas sävstarren totalt vid tjärnens utloppsbäck. I själva verket torde lokalen vara ganska normal; Nordhagen (1940, p. 125) t. ex. uppger den från »bakkemyrer og vass-sig».

Fyndet gjorde mig icke så litet konfys, då jag hade i minnet, att artens kända nordgräns vid Skanderna skulle ligga på ca 800 km:s avstånd WSW i Jämtland (numera vid Övre Ältsvattnet i Lycksele lappmark, vid 64° lat., Rune 1949). »Lejonsprånget» från Jämtland till Kuusamo tedde sig ofattbart.

Förekomsten av *Kobresia* i Kuusamo behöver dock icke vid närmare eftertanke uppfattas som alltför överraskande. Man kan nämligen finna en plausibel förklaring till denna förekomst i ett vidare sammanhang. *Kobresia simpliciuscula* exemplifierar ju en hel grupp av skandiska arter med mer eller mindre disjunkta förekomster just i gränstrakterna mellan Kuusamo och Salla. *Kobresia* intager endast i det avseendet en särställning, att den hittills betraktats som en sydlig unicentrisk art, till vilken uppfattning dock Rune (1949) endast med en viss reservation anslutit sig.

Av dessa disjunkt förekommande arter må följande 20 nämnas:

1) nordliga unicentriska arter: *Woodsia glabella, Melandrium furcatum* ssp. *angustiflorum, Potentilla Chamissonis* och *Arnica alpina*;

2) ± bicentriska arter: *Draba hirta, D. norvegica, Potentilla nivea, Astragalus frigidus*;

3) andra ± disjunkta arter: *Carex Lachenalii, C. atrata, C. glacialis, Juncus triglumis, Salix arbuscula, S. reticulata, Arabis alpina, Saxifraga aizoides, S. cernua, Dryas octopetala, Myosotis silvatica* ssp. *frigida, Veronica fruticans.*

Samtliga arters utbredningsbilder enligt Hultén (1950). Ovannämnda arter med undantag för *Woodsia glabella* och *Kobresia simpliciuscula* har även disjunkta förekomster på Kolahalvön, till vilka det alpina floraelementet i Kuusamo-Salla synes ha de kortaste och naturligaste »historiska» förbindelserna.

Bland mossorna kunde liknande arealgrupper formeras (jfr Tuomikoski 1939 och Auer 1944), ävenså bland några lavar, såsom *Parmelia austerodes* och *Tholurna dissimilis* (jfr Ahlner 1948).

En mycket viktig olikhet må med skärpa framhållas. Medan den största delen av nyss uppräknade arter i Skanderna helt och hållet, eller åtminstone i huvudsak, förekommer i fjällregionen, ligger förekomsterna i Kuusamo-Salla nästan utan undantag i barrskogsregionen (*Kobresia* vid ca 270 m ö. h.) på kalkrika och ofta skuggiga avsatser på klippväggar i klyftdalar (vida kända är ju kanjondalarna vid Juuma, Kuusamo), ävensom vid strida älvar (Oulankajoki, Kitkajoki, Kutsajoki) eller smala sjöar (Nivajärvi) samt därtill i källbäckar och rikkärr. Endast *Carex Lachenalii, C. atrata,*

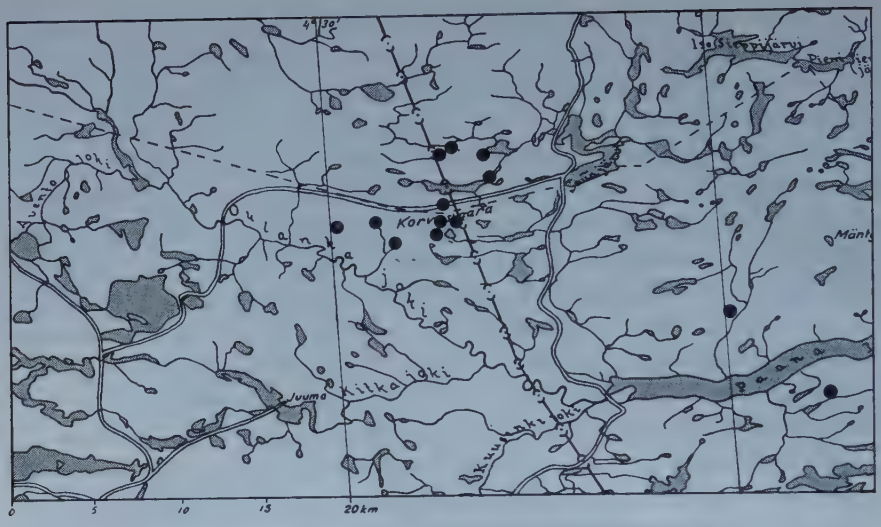

Fig. 4. *Juncus triglumis* L. i Kuusamo och södra Salla.

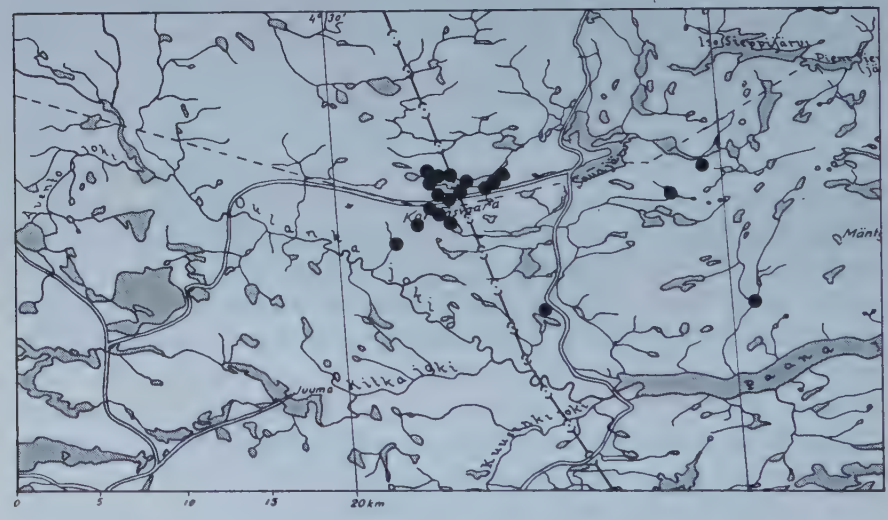

Fig. 5. *Cypripedium Calceolus* L. i Liikasenvaara (strax väster om Korvasvaara)–Korvasvaara–Paanajärvi-trakterna i norra Kuusamo och södra Salla.

Arabis alpina, Saxifraga cernua och *Veronica fruticans* har av dessa arter blivit funna även i fjällregionen (Salla, Vuosnatunturi).

Alla de nämnda arterna är ± eutrofa och kalkgynnade. Liikasenvaara-Korvasvaara-trakten uppvisar dolomitlager eller dolomitförande kvartsitskiffrar i fast klyft, men även moränen måste vara synnerligen kalkrik. Detta framgår bl.a. redan av *Cratoneuron-*

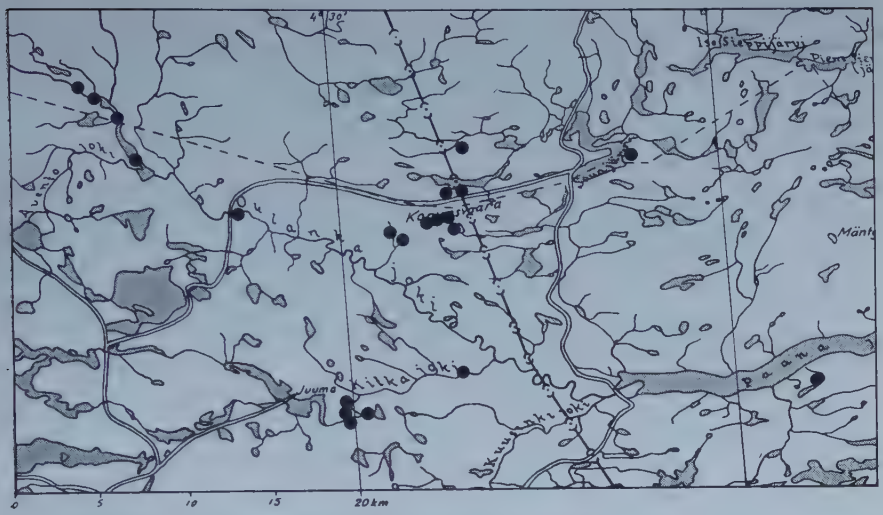

Fig. 6. *Saxifraga aizoides* L. i norra Kuusamo och södra Salla.

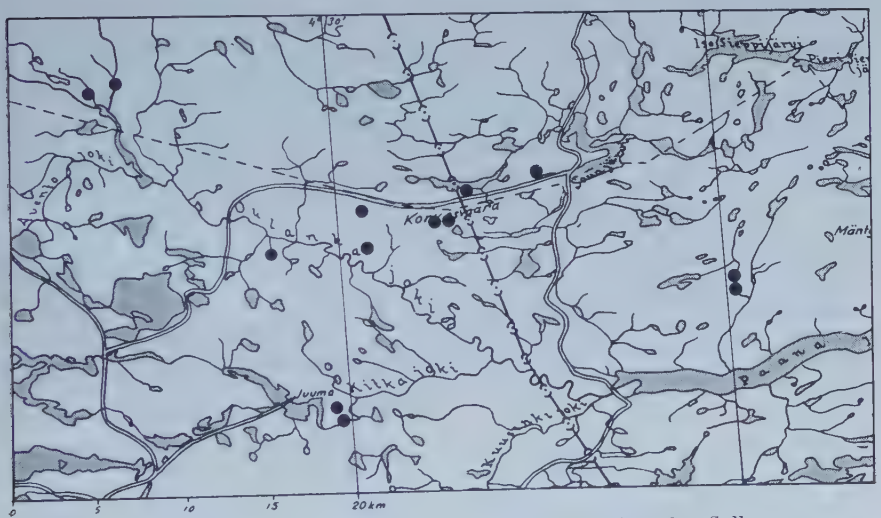

Fig. 7. *Salix reticulata* L. i norra Kuusamo och södra Salla.

mattorna i bäckarna (se ovan). Samma dag *Kobresia simpliciuscula* blev påträffad fann jag även kalkbleke på stranden av Ylä Kuivajärvi, jfr bilden hos LUMIALA 1939, p. 3. Tidigare hade kalkbleke påträffats i Finland endast en gång, och även då i samma trakter, Salla, Vuorijärvi (HYYPPÄ 1936, p. 427).

1937 påträffades kalkbleke eller väl rättare i det här fallet sjökrita

alldeles i närheten av *Kobresia*-lokalen, dels som stora mjuka block på bottnen av Vanhalampi, dels under torvlagret som ett tjockt sammanhängande skikt (Lumiala 1939, p. 1–2). Sedimentskiktet, ända till 190 cm tjockt, är till färgen vitt och består av nästan rent kalciumkarbonat (enligt prof. E. Kivinens analys 90,03 % $CaCO_3$, 2,48 % $MgCO_3$, resten vatten och olösliga ämnen). Kalkbleket vid Ylä Kuivajärvi innehöll ca 45 % $CaCO_3$. Kalkbleke är en i Finland ytterst sällsynt jordart; desto mera intressant är det, att det i vissa fall såsom här »ammats» av dolomit. På grundvalen av det nämnda kan man tryggt påstå, att kalkens inverkan på *Kobresia*-lokalen är så stor, som den överhuvud kan vara hos oss i lösa jordlager.

Även bifogade kartor (fig. 4–7) över utbredningen av *Juncus triglumis*, *Cypripedium Calceolus*, *Salix reticulata* och *Saxifraga aizoides* torde tydligt påvisa en klar anhopning av fyndorter närmast till Liikasenvaara-Korvasvaara-trakten. De ekologiska betingelserna för *Kobresia simpliciuscula*'s förekomst just i dessa trakter har väl sålunda blivit tillfyllest belysta.

Nu återstår endast den viktiga frågan om beståndets ålder på Korvasvaara. Dess storlek talar närmast för en högre ålder. *Kobresia*'s frånvaro vid andra *Juncus triglumis*-bäckar tyder på, att arten även på korta distanser saknar recent spridningsförmåga; inskränkningen till enbart bäckranden framhäver artens ringa konkurrensförmåga under nu rådande förhållanden. Allt talar för en reliktförekomst. Men vi kan icke förbise, att arten, om den är »gammal» på platsen, borde ha haft ännu svårare tider under den postglaciala värmeperioden. Huru har den kunnat överleva denna?

Utan att närmare kunna ingå på denna viktiga fråga måste jag i huvudsak hänvisa till Lumiala (1939), som i sitt intressanta arbete (pp. 11–12) skriver:

»Soweit es sich um die alpinen Arten des Korvasvaara (*Juncus triglumis*, *Kobresia caricina*, *Saxifraga aizoides* u. a.) handelt, verdient der Umstand Beachtung, dass sowohl während der Ancylus- als der Litorinaperiode die Niederschlagsmengen in der Korvasvaara-Gegend genügend hoch für eine gleichmässige Versorgung der aus den Quellenadern entspringenden kleinen Bäche gewesen sind, wenigstens danach zu schliessen, dass von diesen Quellenbächen mitgeführtes Kalziumkarbonat sich auch zu jener Zeit reichlich auf dem Boden des Vanhalampi abgesetzt hat. Und weiter ist zu bemerken, dass gerade hier wie auch anderweitig in der Nähe (z. B. an den Ufern des Sees Korvasjärvi) jene vorgenannten Vertreter der alpinen Florenelemente gegenwärtig ausschliesslich in der unmittelbaren Nähe der Quellenbäche auftreten, ja man kann sagen, direkt an diese gebunden sind. Vielleicht

haben diese Arten es gerade jenem günstig wirkenden mikroklimatischen Faktor, dem kalten Quellenwasser zu verdanken, dass es ihnen möglich gewesen ist, im Konkurrenzkampf auch gegen biotisch kräftige Neuankömmlinge erfolgreich standzuhalten — doch nur an jenen schmalen und nährstoffreichen mineralgründigen und dünntorfigen Ufersäumen der Quellenbäche . . .»

Citatet synes omotiverat långt; däri beröres dock synnerligen viktiga »springande punkter», som är väl belysta. Med citatet har jag även velat hugfästa min i kriget (1944) stupade kamrats minne.

Jag har mycket litet att tillägga. Under värmeperioden saknades de nu dominerande granskogarna totalt på Korvasvaara (intill ca år 1000 f. Kr., Lumiala p. 5). Vanhalampi-tjärnen omgavs då enbart av sjökrita-avlagringar över 2 m under den nuvarande nivån. På *Kobresia*-sluttningen var torvlagret ännu tunnare än i nutiden och förmodligen icke sammanhängande, då torvtäcket även nu är relativt tunt. På mineraljordsblottorna kunde de alpina arterna således ha ännu större arealer till förfogande. Det kalla sippervattnet kunde temperera mikroklimatet och var för beståndets fortsatta levnad av eminent betydelse.

Detta antagande stödes av en liten men viktig detalj från nuet. *Kobresia simpliciuscula*-beståndet når icke fram till utloppsbäcken mellan den lilla tjärnen och Ylä Kuivajärvi och detta i trots av riklig tillgång på diasporer. Och orsaken härtill? Tjärnvattnet representerar icke mera kallt källvatten. *Juncus triglumis* och *Saxifraga aizoides* är i detta hänseende icke fullt så kräsna. Den sistnämnda växer t. o. m. ännu nere på blekeblandad grund vid Ylä Kuivajärvis strand.

Även de andra disjunkta arterna i Skanderna är numera ± kräsna ståndortsspecialister i Kuusamo-Salla. Detta jämte hela artgruppens förekomst här talar för ett mycket gammalt floraelement (vilket även av andra forskare tidigare antytts), vars närmare studium erbjuder mycket av intresse.

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EXPERIMENTAL TAXONOMICAL STUDIES IN THE ARABIS HOLBOELLII COMPLEX.

BY

TYGE W. BÖCHER.

(Botanical Institute, University of Copenhagen.)

1. Introduction.

In a previous paper (Böcher 1951) it was shown that *Arabis holboellii* of North America and Greenland forms an amphi-apomictic complex. Among the chief tasks of future research reference was made to culture experiments with different races under uniform conditions. In the same paper (pp. 47—48) some few preliminary data concerning the genotypical variation were given already. The present paper deals with a number of cultivation experiments carried out during 1950—1954 in the Botanical Gardens of the University of Copenhagen and on the experimental field at Albertslund west of Copenhagen. In the gardens the plants were kept in pots, whereas at Albertslund they were planted out in the field soil which was very loamy. The material consisted of one strain from East Greenland, seven from West Greenland, two from Quebec, five from Wyoming, two from Yukon, one from Alaska and one from California.

2. Cultivation experiments.

Four cultivation experiments were undertaken. In the text and in Table I they will be denoted as I, II, III, and IV.

I (*1950—1951*): The experiment included three triploid and two diploid strains from Greenland, and further one diploid strain of *A. retrofracta* from Alaska. The plants were divided into batches of 10—20 plants which were cultivated at Albertslund (A) and in the Bot. Gardens (B).

II (*1951—1952*): The Greenland material comprised two triploid and three diploid strains. From N. America, moreover, three strains of *A. re-*

Table I. Cultivation

The figures indicate the average length in cm of the longest shoot; the ranges are added ranges are

	Cult. no.	Exp. I (1950—1951)			
		I A, 1950	I A, 1951	I B, 1950	I B, 1951
A. holboellii var. *holboellii*	1075	r_1 r_3	fl_1 53 (36—64) fl_2 42 (25—51)	r_3 r_4	fl_2 42 (32—50) d
	860	r_1 r_3	fl_1 (58) fl_2 42 (16—55)	r_1 r_3—r_4	fl_1 61 (39—77) fl_2 48 (42—59)
	870				
	944	r_1 r_3—r_4	fl_1 64 (60—66) fl_2 43 (29—56)	r_1 r_3	fl_1 (43—55) fl_2 (49)
	2982				
A. holboellii var. *tenuis*	1062	r_4 fl_1	fl_2 19 (14—25) d or r_6	r_1 fl_1	fl_1 (28, 40) d or fl_2 (29)
	1070	(r_1) fl_1	fl_1 (65) fl_2 30 (17—57) or d	(r_3) fl_1	fl_2—fl_3 29 (16—38) d or r_6
	2780				
A. retrofracta	1078	r_1 (r_2—r_3)	fl_1 51 (27—69) fl_2 (37, 44)	r_1 (r_2—r_3)	fl_1 (34, 52) fl_2 (52, 63)
	2820				
	2740				
	2980				
A. collinsii	2975				
	3090				

xperiments.

brackets. In cases where only very few plants were available for measuring, only the iven.

Exp. II (1951—1952)		Exp. III (1952—1953)		Exp. IV (1953—1954)	
1951	1952	1952	1953	IV A, 1953	IV B, 1953
r_1 (r_3)	fl_1 88 (60—118) fl_2 (89—105)			r_1 r_3 r_4 (r_5)	r_1 (r_3)
(r_1) r_3	fl_1 (62) fl_2 66 (49—80)			r_1 r_3 r_4 (r_5)	r_4 (r_5)
		fl_1 22 (15—37) fl_2 18 (11—30)	fl_3 34 (30—40) fl_2 36 (27—43)		r_1*
r_3 (r_4)	fl_2 41 (36—45) d or r_6			fl_1 r_3—r_4 } d	fl_1 (r_3), (r_5)
r_3 r_4	fl_2 42 (30—52) d or r_6			fl_1 r_3—r_4 } d	fl_1 r_3—r_4
r_3 (r_4)	fl_2 38 (17—48) d or r_6			fl_1 $\pm d$	fl_1 r_2—r_5
r_1 (r_2)	fl_1 72 (56—78) d or fl_2 (57)			r_1	r_1
(r_1) r_2—r_3	fl_1 (52, 58) fl_3 78 (43—103)			r_2 or r_5	r_2 or (fl_1)
r_2—r_3	fl_2–fl_3 51 (30–66)			r_1—r_2	r_1—r_2
		(r_2) or r_4 fl_1 (10—20)	(fl_1), fl_3 34 (26–44) d or r_6		r_1*
		r_1 r_2	fl_1 44 (32—60) fl_2 (40—51)		r_1*
		r_1 (r_2) or (r_4)	fl_1 47 (28—68) fl_2 (25—35) or d		r_1*

* Seeds sown late in June 1953.

trofracta and four strains which seem to be of hybrid origin were cultivated. All plants (about 10 of each strain) were kept in pots in the Bot. Gardens.

III (*1952—1953*): A small experiment with one triploid strain from East Greenland, one diploid of *A. retrofracta* from Yukon, and two diploid or tetraploid strains of *A. collinsii* from Quebec. The plants were grown in pots in the Botanical Gardens (15—30 plants of each strain).

IV (*1953—1954*): The same strains as in experiment II were cultivated at Albertslund (A, 15—20 plants of each strain) and in pots in the Bot. Gardens (B, 10 plants of each strain). The seeds were sown late in March 1953 and germinated early in April. In experiment II the seeds were sown early in April and they germinated late in the same month.

The results of the cultivation experiments appear from Table I and are discussed in detail in the next section. Very important differences were found in regard to the development and earliness of the plants. In the table the different developmental stages are indicated with a number of signs. The explanation of these signs is as follows:

r_1 Normal unbranched rosette of basal leaves (Fig. 3).
r_2 Elongated rosette.
r_3 Main axis short and branched at base forming many rosettes, not flowering but dying away at the top.
r_4 Main axis flowering, although almost without stretching, many basal rosettes retained (Fig. 3).
r_5 As r_4, but main axis produces one or more new rosettes at the top after having flowered a short period; this rosette formation is followed by another flowering and stretching (Fig. 3).
r_6 New rosettes are formed at the base after flowering of main axis which dies away to the base.
fl_1 Racemes on an elongated simple main axis which frequently branches in the central part (Figs. 1—2).
fl_2 Racemes on many stems from the base of the plant; main axis dead (Figs. 1—2).
fl_3 Racemes on branches from the middle part of the main axis, the top of which is dead (Figs. 1—2).
d The whole plant dead after flowering or stretching.

3. Triploid Arabis holboellii Hornem. from Greenland (2n = 21).

The type specimen of *Arabis holboellii* Hornemann, which is beautifully illustrated in Flora Danica XI, Plate 1879, shows some of the most important characteristics of the triploids in my material, *viz.* large flowers, long siliques and large seeds. Therefore, it is highly probable that the type was triploid. It was collected on Disko Island in West Greenland, undoubtedly at Osterlien, a famous botanical station in the vicinity of Godhavn. From Osterlien I got

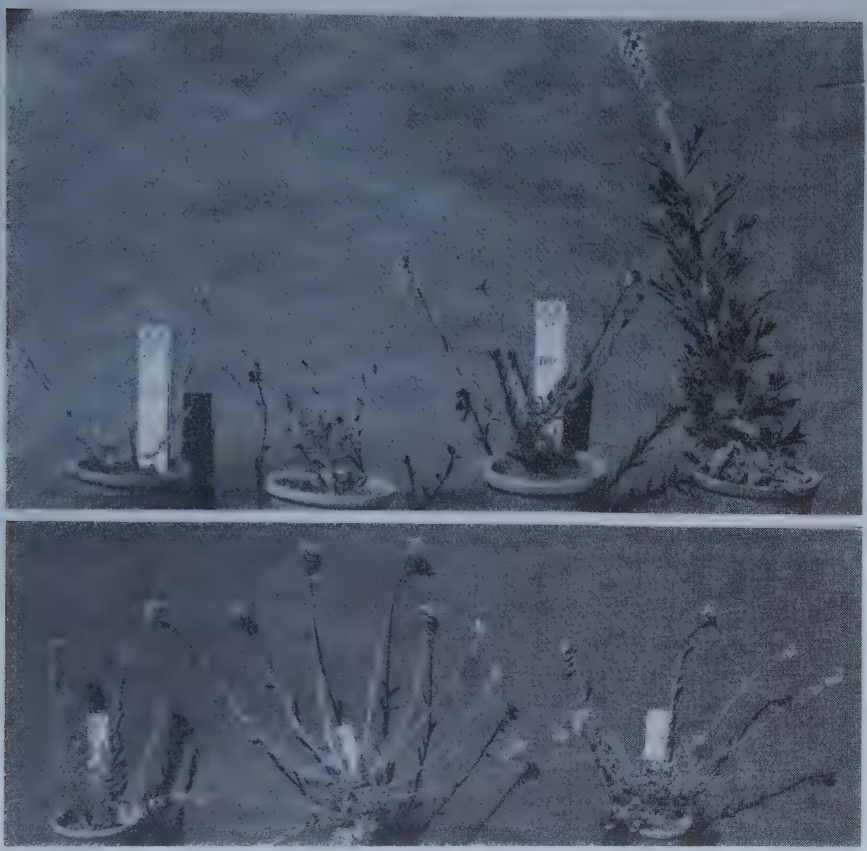

Fig. 1. Cultivation experiment I (1950—51). Upper row left, no. 1070 diploid *A. holboellii* var. *tenuis* from Greenland (fl_2 and fl_3). Upper row right, no. 860 triploid var. *holboellii* from Greenland (fl_2 and fl_1). Lower row left, no. 1078 *A. retrofracta* from Alaska (late flowering) and triploid *A. holboellii* from Greenland. The central plant (no. 1075) from the type locality, the plant to the right no. 944 from Eqaluit, all fl_2. Phot. May 18, 1951.

two seed collections which proved to be partly triploid (cult. no. 1075), partly diploid (cult. no. 1062). The seeds were collected by Professor C. A. Jørgensen.

In addition to cult. no. 1075 from Disko (Disko 2 in the previous paper) the following triploid strains have been cultivated: nos. 860 and 870 from Søndre Strømfjord (S. Str. 3 and 9 in the previous paper), no. 944 from Eqaluit, 70° 24′ lat. N., in West Greenland (seeds collected by Knud Jakobsen, M.Sc.), and no. 2982 from Bjørneoerne in Scoresbysund, East Greenland (seeds collected by Mr. Behrendt Andersen). Apart from the latter strain, which has

Fig. 2. Cultivation experiment III (1952—53). Upper row, *A. collinsii* from Quebec nos. 3090 (left) and 2975 (right), both fl_2 and fl_1. Lower row, second-year flowering plants of triploid *A. holboellii* from Scoresbysund (fl_2 and fl_3). Phot. May 2, 1953.

only been studied cytologically in order to establish its chromosome number, all the other triploids have proved to be apomictic. From the cultivations of the triploid strains (Table I) it appears that these are generally biennials with a normal rosette stage, followed next year by an elongated flowering main axis (Fig. 1, upper row to the right). Rather frequently they can, however, produce many rosettes in the first year, and next year many stems from the base (Fig. 1, lower row); this tendency was particularly pronounced in no. 944 which, further, deviated as regards the shape of the rosette leaves (Fig. 5). No. 1075 deviated in having pale, purplish flowers, whereas the other strains had white flowers.

A greatly deviating behaviour was noticed in the plants from East Greenland (no. 2982), which were sown in April (exp. III). They flowered the first summer and — a fact which is rather unique — frequently formed elongated flowering branches from the base even in the first summer. It was further very interesting to note that the majority of the plants, in spite of first-year flowering, continued life and flowered again next year after which they died. The plants were thus biennial but flowering in both seasons. As to their life-form these plants were chamaephytes with wintering buds above the surface of the soil (cf. Fig. 2, lower row).

The most important morphological and biological characters of the triploids may be summarized in the following description and naming:

Arabis holboellii var. ***holboellii.*** Triploid, most frequently biennial plants with simple flowering stem or with several flowering stems issuing from the base. Vigorous plants with large flowers, 6—8 mm long when fully developed, and with long and broad siliques, 2.0—2.6 mm broad and 40—60 mm long, not uncommonly up to 70 mm long, seeds rather large, their largest diameter being 1.4—1.8 mm.

4. Diploid Arabis holboellii Hornem. from Greenland (2n = 14).

Diploid plants differ from triploids in a number of characteristics among which the biological ones are very conspicuous. As may be seen from the data in Table I the diploids very frequently flower in the first year. In general they die away after the ripening of the siliques but sometimes they may also continue life by forming new basal rosettes (r_6). Sometimes they behave like the triploids from East Greenland (no. 2982) and flower for two years, the second year always from branches issuing from the lower or the middle part of the main axis (Fig. 1, upper row, left).

The two strains nos. 1062 and 1070 were almost identical. The seeds originated from Disko (no. 1062) and Søndre Strømfjord (no. 1070, cf. Disko 1 and S. Str. 10 in the previous paper). On the other hand, no. 2780 from Atanikerdluk in West Greenland (seeds collected by Knud Jakobsen, M.Sc.) deviated greatly: it was quite glabrous, and the plants consequently bright green, not greyish green.

Compared to corresponding triploid plants, the diploids are lower and have smaller flowers. The difference may not be large enough to establish a new subspecies and therefore I have chosen the following naming and description of the diploid Greenland plants.

Arabis holboellii HORNEM. var. ***tenuis*** var. n.

Differt a varietate *holboellii* omnibus partibus tenuioribus (floribus 4—6 mm longis, siliquis 1.8—2.1 mm latis, 30—50 mm longis, rarissime longioribus, seminibus 1.2—1.55 mm latis), planta, cum in Dania culta, annua, vel bienni utroque anno florente, chromosomatibus in cellulis somaticis: 14.

Hab. in Groenlandia occidentali. Typus ex Itivdlinguaq sinus Søndre Strømfjord a T. W. BÖCHER relatus, in Horto Botanico Hauniensi cultus, ibi 22.5. 1951 lectus, in Museo Botanico Hauniensi depositus.

Arabis holboellii HORNEM. var. ***tenuis*** f. ***glabra*** f. n.

A typo differt omnibus partibus glaberrimis.

Hab. in Groenlandia occidentali. Typus ad Atanikerdluk 6.9. 1950 a KNUD JAKOBSEN lectus, in Museo Botanico Hauniensi depositus.

As may be seen from the diagnosis, the var. *tenuis* differs as to size and life-form. In herbaria primarily the size of the fully developed flowers and secondarily the size of the siliques and seeds may be used for determination. Unfortunately a great many specimens are without flowers and can hardly be determined exactly.

5. Arabis retrofracta (Graham) Rydberg from North America.

This may be regarded as an independent species or as a subspecies of *A. holboellii*. My material which includes four strains from very different parts of Western North America is morphologically distinct from all Greenland plants. Thus, the distinguishing characteristics mentioned by ROLLINS 1941 p. 440 in the key to the *Arabis holboellii* complex are maintained in culture.

No. 1078 from Alaska (seeds obtained through the Copenhagen Bot. Gardens, cf. "Alaska" in the previous paper), no. 2980 from Yukon (Tantalus Butte, GILLETT and MITCHELL no. 3997) and no. 2740 from California (Scott Valley, Siskyou Co., leg. LINCOLN CONSTANCE) proved to be diploids, in the case of no. 1078 with normal sexual seed development, while no. 2820 from Wyoming (Hoback River, Teton Co., A. A. BEETLE no. 10410) contained diploid as well as pentaploid plants (2n = 35, Fig. 4 c). Introductory studies on the pollen development of the latter revealed that even diploids have a disturbed meiosis terminating with dyad formation and indicating apomixis.

From the cultivations (Table I) it appears that most strains are biennial with a normal or elongated rosette in the first year (Fig. 3). In some plants, however, the main shoot dies, causing a branching

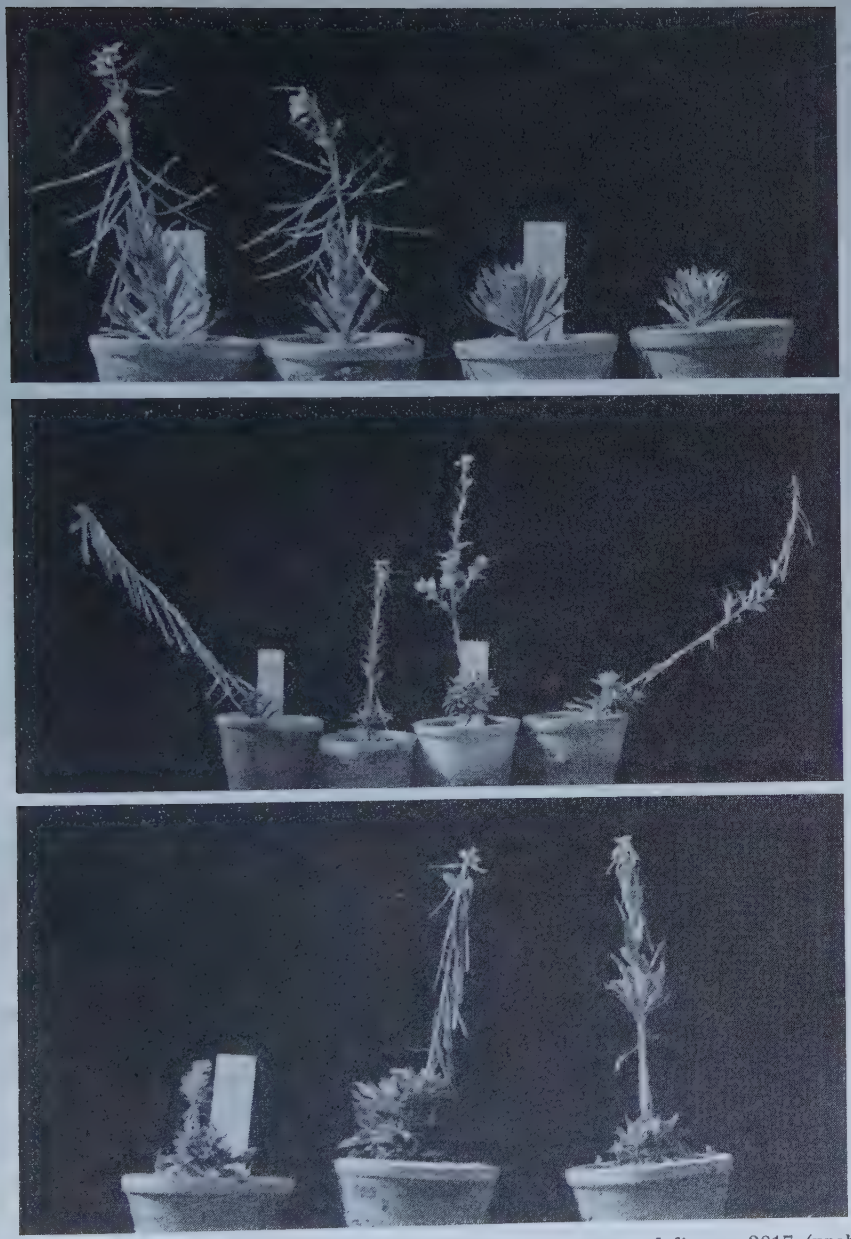

Fig. 3. Cultivation experiment IV B (1953—54). Upper row left, no. 2817 (probably *A. divaricarpa* × *holboellii* coll.) from Wyoming (fl_1). Upper row right, no. 2740 *A. retrofracta* from California (r_1). Middle row, *A. holboellii* var. *tenuis* (left var. *glabra* (no. 2780), right typical no. 1062), fl_1 (left specimen) and r_5. Lower row, var. *holboellii* no. 944 (r_4 and to the right r_5). Phot. August 11, 1953.

from the base next year (Fig. 1). No. 2980 deviated in flowering the first year, after which most of the plants died (exp. III). In exp. IV, where the seeds were sown late, only normal rosettes were formed the first year. All strains were flowering late as compared with the Greenland material.

6. Arabis collinsii Fernald from Quebec.

As in the case of *A. retrofracta* I prefer to regard this unit as a species or at least a subspecies of *A. holboellii*. The two strains from Quebec (no. 3090, seeds collected in nature and obtained through the Montreal Botanical Gardens; no. 2975 from Bic, Rimouski Co., leg. LEPAGE and CHAMPLAIN) were almost alike, although the former proved to include tetraploid plants (2n = 28) and the latter to contain diploid plants (cf. Fig. 4 a, b). The important characteristic of large spreading hairs on the lower stem remained in culture. The fully unfolded flowers, however, did not differ in size from the *retrofracta* plants; the flowers of both strains were 7—8 mm long, and those of the *retrofracta* plants 6—10 mm. The rosette leaves which are found in the first summer are very short (Fig. 5). On the other hand, some very broad and rather large basal leaves are formed in the first part of the flowering season immediately before the elongation of the main axis begins.

7. Triploid material of hybrid origin, probably involving Arabis divaricarpa and a species of the A. holboellii complex.

In 1951 Professor R. C. ROLLINS kindly sent me some seeds taken from two collections made in Wyoming by A. A. BEETLE (BEETLE nos. 11191 and 11398). In his letter Professor ROLLINS suggests this material to be of hybrid origin; he says that BEETLE's no. 11191 from Mt. Dnyankara is a mixed collection and that possibly the population was intermixed through hybridization. The collection 11398 from the west side of Brooks Lake is characterized as somewhat intermediate between *A. holboellii* and *divaricarpa*. BEETLE's no. 11191 was divided into three portions which were sown separately under the cult. nos. 2816, 2817, and 2818. His no. 11398 was called no. 2819. According to ROLLINS, the material cultivated as no. 2816—17 may be hybridogenous and involve *A. collinsii* and *divaricarpa*; no. 2818 was suggested to be closely related to what has been called *A. holboellii* var. *pinetorum*, although it was lacking the broad basal leaves of this variety.

Fig. 4. Chromosomes in root tip mitoses. *a—b*, *A. collinsii* (*a*, no. 2975, 2n = 14; *b*, no. 3090, 2n = 28); *c*, *A. retrofracta* from Wyoming (no. 2820, 2n = 35); *d—e*, probably *A. divaricarpa* × *holboellii* (coll.) (*d*, no. 2816; *e*, no. 2817, 2n = 22). ×2900.

The plants were cultivated in experiments II and IV. In exp. II all four strains formed normal rosettes the first year, but in exp. IV, where the seeds were sown early, this applied only to nos. 2816 and 2818, whereas no. 2817 flowered the first year and no. 2819 flowered or had very elongated and branched rosettes. Second-year plants following after normal rosette stages in the first year reached average heights of 60, 73, and 67 cm (nos. 2816—17—18) and 45 cm (no. 2819).

Two characteristics were clearly of special interest — the direction of the mature fruiting pedicels and the marginal equipment of the rosette leaves. In all four strains the fruiting pedicels spread sometimes at right angles to the rhachis (Fig. 3) and never did they strongly descend or reflex as in the *A. holboellii* complex. All four strains had further distinctly dentate basal leaves, and this, together with the spreading pedicels and the sparse pubescence, strongly speaks in favour of the idea that the material belongs to a fertile hybrid between *A. divaricarpa* and a species of the *A. holboellii* complex.

Cytological data now at hand support this theory of hybridity. According to Rollins 1941 (p. 303), material of *A. divaricarpa* from Utah and Colorado has 2n = 16 and 30. These numbers deviate from those of the *A. holboellii* group in which all counts belong to a series with seven as the basic number (2n = 14, 21, 28, 35, 42). The number 30 would be easily understood as resulting from a cross between a plant with 2n = 16 and a plant with 2n = 14, which is far from being impossible, as a species like *A. drummondi*, closely related to *A. divaricarpa* according to Rollins, has 2n = 14. Now, if a *divaricarpa* plant with 2n = 16 crosses with a tetraploid of the *holboellii* complex, or a *divaricarpa* plant with 2n = 30 crosses with a diploid of the *holboellii* complex, a hybrid will arise which has the number 2n = 22. In fact, exactly this number was found in nos. 2816—2817 (Figs. 4 d, e), whereas no. 2818 probably had the triploid

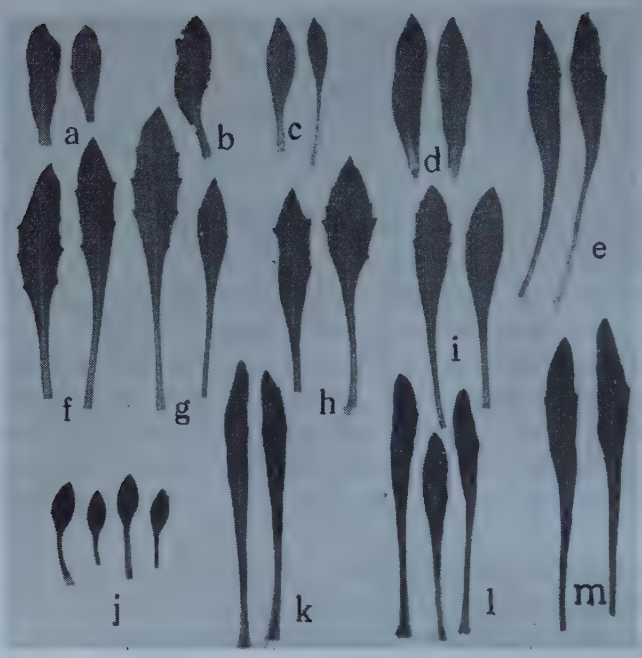

Fig. 5. Basal leaves of *A. holboellii* and related species (exp. II and, for no. 3090, exp. IV). *a*—*c*, *A. holboellii* var. *tenuis* (*a*, no. 1062; *b*, no. 1070; *c*, no. 2780); *d*—*e*, *A. holboellii* (*d*, no. 944; *e*, no. 870); *f*—*i*, probably *A. divaricarpa* × *holboellii* (coll.) (*f*, no. 2819; *g*, no. 2818; *h*, no. 2817; *i*, no. 2816); *j*, *A. collinsii* (no. 3090; the very small size probably a result of late sowing); *k*—*m*, *A. retrofracta* (*k*, no. 2820; *l*, no. 2740; *m*, no. 1078). ×0.6.

number 2n = 21. No. 2819 had another deviating number, 2n = 23, which may have arisen as a result of a fusion of an unreduced cell with 2n = 16 and a cell with 7 chromosomes.

It is of course not possible to clear up satisfactorily a hybrid material of such a complexity without knowing more about the suggested parent species which may occur in or near the stations where BEETLE made his collections. It has been made highly probable that *A. divaricarpa* and *holboellii* coll. form a hybrid swarm, and preliminary studies on the meiotic behaviour of the four cultivated strains strongly suggest that these may be apomictic, which makes the fertility of the plants explainable.

In connection with the data mentioned above a discussion of the material of *A. holboellii* from the Copenhagen Botanical Gardens may be of some interest. According to my earlier paper this "HBH" material has 2n = 22 or 2n = 21 + 1 as one of the chromosomes was

much smaller than the rest. The find of two strains with 2n = 22 (nos. 2816—17) and the fact that one very short chromosome occurs in no. 2816 (Fig. 4 d), induced me to reinvestigate the garden plants. They all appeared to have dentate basal leaves with sparse pubescence, almost as in nos. 2816—19 but with shorter and more numerous teeth. The fruiting pedicels were strongly reflexed (cf. Fig. 15, left, in Böcher 1951) as in *A. retrofracta* or *collinsii*. I have searched in vain for a similar type of denticulation of the basal leaves in the Greenland collections in the Copenhagen Botanical Museum, but found it on a plant collected by the late curator of the Copenhagen Botanical Gardens Axel Lange. This material originated from the Botanical Gardens at Berlin-Dahlem, and may have been sent to Berlin from some place in America. Many facts thus suggest that the material in the Copenhagen gardens is of American extraction and not from Greenland as earlier suggested, and that it is a fertile apomictic hybrid between two species, e.g. between *A. divaricarpa* and *A. collinsii*. It deviates from the material from Wyoming (nos. 2816—19) mainly as to the direction of the fruiting pedicels, but this does not necessarily prove a different origin. Several different combinations are thinkable: if two genomes of the *holboellii* complex (with genes for reflexed pedicels) are united with one *divaricarpa* genome, the result may be similar to that of the "HBH" material, whereas combinations of two *divaricarpa* and one *holboellii* genome may give rise to plants like those cultivated from Wyoming, which had spreading pedicels.

8. Discussion and Conclusions.

Cultivation experiments with different strains belonging to the *Arabis holboellii* complex have shown that this complex includes rather distinct units which most naturally may be interpreted as species or at least subspecies. The Greenland population consists of triploids and diploids. The latter are of somewhat smaller size and have been referred to a special unit, var. *tenuis*. The cultivated Greenland material as a whole differs from that originating from North America.

The occurrence in America of plants closely resembling Greenland plants may deserve renewed studies. The possibility exists that such plants, at least in some places, may be due to hybridization among strictly American species or subspecies. The very disrupted

range of typical *A. holboellii* in North America (see details in Hopkins 1937 p. 171—172, Rollins 1941, Porsild 1943 p. 43, 1951 p. 200, Hultén 1945 p. 874) may of course mainly be the result of perglacial survival as proposed by Fernald 1925, but the very scattered stations which most frequently lie within the range of the other components of the complex, as well as of *A. divaricarpa*, may also suggest typical *A. holboellii* in America to be triploid hybrids which owing to special gene-combinations assumed a close resemblance to the Greenland triploids, the latter probably being autotriploids (cf. the discussion of the "HBH" material). Porsild (1943) writes about his material from the Great Bear Lake area that it is a perfect match for the plant in its type locality in Greenland, but he also says that his specimens are perennial; this is not the case with the Greenland plants but would agree with the behaviour of the subperennial "HBH" plants.

The study of the material from Wyoming strongly suggests the occurrence in America of fertile apomictic hybrids. This may be of importance for the understanding of the complexity and great polymorphy in some of the North American species of *Arabis*, which in America, in several respects, reminds of the genus *Crepis* so carefully studied by Babcock and Stebbins (1938) and others.

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STUDIES ON HIERACIUM DEMISSUM (STRÖMF.) DAHLST.

BY

INGIMAR ÓSKARSSON.

I. Introduction.

Until recently Icelandic botanists have paid little attention to hieraciology and accordingly Iceland has been inadequately investigated in this respect. It is true that native and foreign botanists have collected many species of *Hieracium* in Iceland, but of the many known forms very few specimens are available, so that it is impossible to estimate the variability of the different species and trace their distribution. According to Omang (1938) 106 species and 17 varieties have been described from Iceland. This seems a rather high number in view of the fact that the country has remained isolated for an enormous length of time. To this number must be added many new species discovered during recent years, which have not yet been described. Most of the Icelandic *Hieracium* species are endemic. The original descriptions of the endemic species were made by the Swedish hieraciologist Dr. H. Dahlstedt (1904) and the Norwegian S. O. F. Omang.

Dahlstedt died in 1934. Since then Omang revised all the Icelandic *Hieracium* material available in the collections of the Botanical Museums in Stockholm, Oslo and Copenhagen, and described many new species and forms. This revision was made with due regard to our increasing knowledge of this difficult genus, and the results were published in 1938.

Seventy years ago a Swedish botanist, H. F. G. Strömfelt, travelled in Iceland in order to collect plants (Strömfelt 1884). He obtained some specimens of *Hieracium*, and these are probably the oldest Icelandic examples of this genus. He found, *inter alia*,

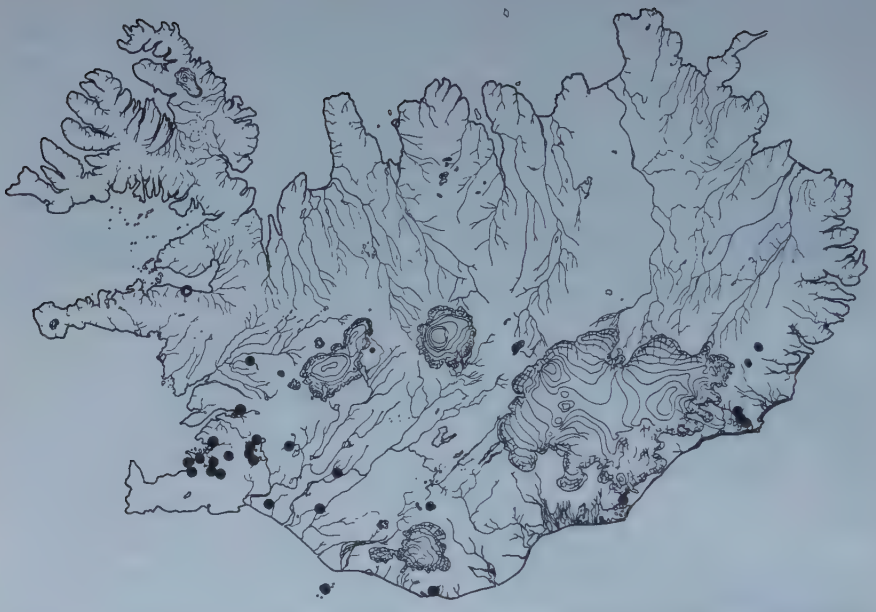

Fig. 1. Distribution of *Hieracium demissum* (Strömf.) Dahlst. in Iceland. The dots denote all known localities and the circle a doubtful locality.

a new endemic species, now called *H. demissum* (Strömf.) Dahlst. This species is found in several localities, but as it is rather sensitive to environmental conditions, it is variable and was sometimes mistaken for other species resembling it. For this reason the present author has made a study of the different forms and their distribution. For that purpose new collections of the plant have been made. In addition, exsiccatae from Naturhistoriska Riksmuseet in Stockholm, the Botanical Museum in Copenhagen and Náttúrugripasafnið in Reykjavík, have been examined.

My thanks are due to the directors of these Institutions for the loan of specimens. The photographs were made by Mr. Gísli Gestsson, to whom I tender my best thanks.

II. List of Investigated Herbarium Specimens Determined as H. demissum (Strömf.) Dahlst.

(1) SE. Icel., at Mígandafoss in Hornafjörður, Aase Jörgensen, 24.7. 1933. Bot. Mus., Copenh. Two specimens (one defective), determ. by Omang. 17—20 (?) cm high, slender and one-headed plant with 5 (?) radical leaves and 2 stem-leaves. Peduncles slightly pilose. Involucres glabrous or nearly so. Fairly usual form.

Hornafjörður: Skarðsgljúfur and Ketillaugarfjall, I. Óskarsson, 4—5.8. 1936. The author's Herb. Two specimens, determ. by Omang. Plants 15 cm high. One of them has many (8?) small, radical leaves and 3 cauline, all entire. 2 heads. Phyllaries with very few pilose hairs on the back. The other specimen, which is labelled forma, has more acute and slightly dentate leaves.

(2) SE. Icel., Fagurhólsmýri in Öræfi, H. Björnsson, 31.7. 1952. The author's Herb. Seven specimens, labelled forma, determ. by the author. 12—21 cm high, very slender plants with 2—4 radical leaves and 2—5 cauline, diminishing suddenly upwards, all entire—denticulate, unusually clearly veined. 1—3 heads. Peduncles moderately floccose with rather densely placed rudimental, subtransparent hairs (pseudoglands)[1] and slightly pilose. Phyllaries with scattered, pilose hairs and solitary glands about the base. Ligules unequally toothed. Styles unusually light-coloured (see Fig. 2).

(3) SE. Icel., Vík in Mýrdalur, I. Óskarsson, 14.7. 1953. The author's Herb. Eight specimens, determ. by the author. 23—53 cm high plants of very different appearance. Three specimens are typical or nearly so. Stem rather densely clothed upwards with pseudoglands. 3 radical leaves and 4 stem-leaves, all subentire or with few, equal and small teeth. Inflorescence 2—3-headed with short branches from the uppermost leaf-axils. As to the pilosity of the involucres, these specimens are similar to those of Fagurhólsmýri (2) (see Fig. 3). The remaining five specimens are higher and more robust, branched from the base of the stem (a three-headed branch from each leaf axil). 1—4 radical leaves and 4—6 stem-leaves, all entire—clearly dentate. Styles light fuscous. These distinct specimens are labelled as var. *macroramosum* n. v. (10).

(4) S. Icel., Vestmannaeyjar, B. Johnsen, 20.7. 1952. The author's Herb. Three specimens (one with undeveloped heads and the two others with defective foliage), labelled forma *pilosa*, determ. by the author. 14—18 cm high, slender plants. 3 radical leaves and 3—4 stem-leaves, all mostly entire. 1—2 unusually large heads and abortive heads in the upper leaf axils. The summit of the stem, the pedicels and the phyllaries are clothed with rather long, scattered pilose hairs. Ligules unequally toothed. Styles yellow—ferruginous.

(5) S. Icel., Árbær in Holtum, S. Stefánsson, 19.7. 1894. Naturh. Riksmus., Stockh. Three specimens, labelled forma. Bot. Mus., Copenh. Two specimens, labelled f. *pilosa*. Náttúrugripasafnið in Reykjavík. One specimen, labelled f. *parce pilosa*. All these specimens are determ. by Dahlstedt, and those from Stockholm revised by Omang, who referred them to the type. The plants are 20—33 cm high. The stem sparsely pilose and slightly floccose, chiefly towards the summit. 1—3 radical leaves, nearly entire, 3—6 cauline entire—denticulate or with wavy margins. One head and some few, abortive heads in the bract axils. Involucres with scattered pilose and stellate hairs and solitary glands about the base.

[1] The pedicels of this species are sometimes ± clothed with fine, translucent hairs resembling small glands without knobby tip. I have called these hairs *pseudoglands*.

Fig. 2. *Hieracium demissum* (Strömf.) Dahlst. (Author's Herb.) Right: from Fagurhólsmýri in Öræfi, SE. Icel. Almost typical. Left: from Kleppur, Reykjavík, SW. Icel. Typical. — $^4/_9$ natural size.

Besides this there is sometimes a single row of pilose hairs on the back of the phyllaries.

(6) S. Icel., Hæli in Hreppar, G. Gestsson, 11.8. 1952. The author's Herb. One specimen, labelled forma, determ. by the author. 30 cm high, slender plant with 2 radical leaves and 3 stem-leaves, all rather small, subentire. 2 heads and 1 abortive. Involucres with scattered, pilose hairs and solitary glands about the base. Pedicels densely clothed with pseudoglands. Ligules unequally toothed. This plant is typical in its foliage but less so as to the inflorescence.

(7) S. Icel., Ásgautsstaðir near Eyrarbakki, H. F. G. Strömfelt, 6.9. 1883. Naturh. Riksmus., Stockh. Three specimens 15—32 cm high, of fairly different appearance. The stem sparsely pilose about the base, otherwise almost glabrous. 2–3 radical leaves, nearly entire, 2—6 stem-leaves, entire or with spreading, acute teeth. Peduncles slightly floccose and with pseudoglands and rudimental, pilose hairs. Involucres glabrous or slightly stellate and pilose and solitarily glandular about the base. 1—3 heads, the terminal

Fig. 3. *Hieracium demissum* (Strömf.) Dahlst. (Author's Herb.) Right: from Þingvellir, SW. Icel. Typical. Left: from Vík in Mýrdalur, SE. Icel. Almost typical. — $^4/_9$ natural size.

one sessile. Leaves of the biggest specimen defective. First determined by Strömfelt as *H. dovrense* Fr. **demissum* n. subsp. Later it was described in detail by Dahlstedt and revised by Omang in 1936 (see Fig. 4).

(8) S. Icel., Laugarvatn, I. Davíðsson, 12.7. 1953. The author's Herb. One specimen, labelled var. *macroramosum*, n. v. forma, determ. by the

Fig. 4. *Hieracium demissum* (Strömf.) Dahlst. (Naturh. Riksmus., Stockh.) From Ásgautsstaðir near Eyrarbakki, S. Icel. The locality of the first finding. Partially typical. — $^4/_9$ natural size.

author. 38 cm high, robust plant, long-branched from below the middle of the stem. 4 radical leaves and 4 stem-leaves, 2 of the uppermost leaves small and entire, the remainder rather coarsely dentate in their lower half. The lowest stem-leaf placed close to the radical leaves, and the following one is situated only 8 cm higher up. Pedicels with solitary, pilose hairs, else resembling the specimen from Brúarland (13), especially as to the pilosity of the involucres and the hue of the styles. This specimen differs considerably from the varietal type from Þingvellir (10), but nevertheless it must be referred to it.

(9) SW. Icel., Svínahlíð near Þingvallavatn, I. Óskarsson, 22.7. 1951. The author's Herb. One specimen with undeveloped heads, labelled as var. *macroramosum* n. v. forma, determ. by the author. 48 cm high, robust plant. No radical leaves and 5 large stem-leaves, 2 leaves at the middle of the stem, clearly dentate, the teeth triangular-shaped, acute. Inflorescence unbranched. Phyllaries with spreading, pilose hairs, eglandular or nearly so. As to the foliage, this specimen is identical with the new variety but less so as regards the inflorescence.

(10) SW. Icel., Þingvellir, G. Kjellberg, 3.8. 1915. Naturh. Riksmus., Stockh. Four specimens, determ. by Omang. Along one of the specimens on the sheet Omang has written with lead-pencil: "Dette eksemplar er ikke *H. demissum*." I agree with Omang. Among other things, the involucres of this specimen differ greatly from those of *H. demissum*, both as to the indument and the shape. The styles are pure yellow. This plant is doubtless a slender form of *H. microdon* Dahlst. The remaining three specimens are almost typical, with 0—2 radical leaves and 3—5 cauline. The leaves are either entire or ± denticulate. 1—2 heads. Some of the phyllaries with solitary, pilose hairs, and obscurely glandular about the base.

The same locality, north and west of Þingvallavatn, I. Óskarsson, 5.8. 1951, 4.8. 1952 and 29.8. 1953. The author's Herb. Nineteen specimens, determ. by the author. These specimens are of very different appearance, mainly as to the height of the stem, the location, size and dentation of the foliage. The height varies from 24 cm to 62 cm, most of the specimens are of 40 –45 cm height. 0 4 radical leaves, entire or nearly so, 3—6 stem-leaves, subentire or dentate below their middle, the teeth are usually few and triangular-shaped. The internodes are long, mainly the upper ones. 1—5 heads. Peduncles densely floccose, rarely pilose. Involucres with solitary or spreading, pilose hairs, and sometimes singularly glandular about the base. Occasionally branches grow from the uppermost leaf-axils (see Fig. 3). One specimen differs so greatly from the other forms that I have considered it justifiable to raise it to varietal rank: var. ***macroramosum*** n. v. I have described the variety as follows:

> Resedens a forma typica, caulis altioribus et crassioribus, foliis basalibus tempore florendi emarcida, foliis cauiinis magnis vel permagnis denticulatis—subintegris, interdum remote triangularo vel laciniato dentatis, ramis ex axillis foliorum caulinorum 2—4, longis, erectis, 3 4 cephalos efferentibus.

This variety is a fairly robust plant without radical leaves, with subentire (from other localities with triangular-shaped teeth) (17), very large stem-leaves near the base, and with 9—18 cm long branches from the 3 upper leaf-axils. (3) and (8), (see Fig. 5).

(11) SW. Icel., Esja (on a grassy slope), I. Óskarsson, 29.7. 1951. The author's Herb. One specimen with undeveloped heads, determ. by the author. 50 cm high plant with 1 radical leaf and 6 large cauline, the 2 median with a few triangular-shaped teeth. The inflorescence long-branched from below the middle of the stem. Peduncles and the phyllaries typical. Must be referred to the new variety from Þingvellir.

(12) SW. Icel., Reykjafell in Mosfellssveit, I. Óskarsson, 10.8. 1952. The author's Herb. Two specimens referred to the type, determ. by the author. 22—26 cm high plants with 1—2 radical leaves and 3 stem-leaves. The uppermost leaves very small, all entire—subentire. 2 heads and besides an abortive head in one of the leaf-axils. Pedicels with a few hairs. Involucres with scattered, pilose hairs below and obscurely glandular. Ligules unusually long-toothed. Styles ferruginous—yellow brown.

(13) SW. Icel., Brúarland in Mosfellssveit, I. Óskarsson, 11.8. 1953. The author's Herb. One specimen, labelled var. *macroramosum* n. v. forma, determ. by the author. 32 cm high plant with destroyed stem, but a long branch growing from one of the lowest leaf-axils, has undertaken its task. 6 leaves, the radical leaves not clearly separated from the lowest cauline. 2 of the leaves near the base are remarkably large, with some few, triangular-shaped, big teeth. The other leaves small, entire. Inflorescence with 3 one-headed, lateral branches above the middle of the stem and an abortive flowerhead in a leaf-axil at the lower part of the stem. The pilosity of the pedicels and the involucres rather scanty. Styles dark yellow—ferruginous. This characteristic specimen seems to be an intermediate form between the type and the new variety (see Fig. 6).

(14) SW. Icel., Lækjarbotnar, I. Óskarsson, 3.8. 1952. The author's Herb. Three specimens, labelled forma, determ. by the author. 18—30 cm high plants with 1—3 developed heads and 1—2 abortive heads. In other respects similar to that from Heiðmörk (15).

(15) SW. Icel., Heiðmörk, Ó. Ingimarsson, 6.8. 1951. The author's Herb. One specimen, labelled forma, determ. by the author. 25 cm high plant with 1 radical leaf and 4 stem-leaves, of which 2 are placed very near the base, all with few, scattered teeth to subentire. 1 head and 2 abortive. Involucre with spreading, pilose hairs. Almost typical.

(16) SW. Icel., Hafnarfjörður, I. Óskarsson, 10.7. 1953. The author's Herb. Six specimens referred to the type, determ. by the author. 18—28 cm high, slender plants with 3—4 radical leaves and 2—3 cauline with long internodes, all slightly dentate. 1—3 heads. Peduncles and the phyllaries with scattered, pilose hairs, and the base of the involucres with solitary glands. Styles brownish.

(17) SW. Icel., Álftanes, I. Davíðsson, 30.8. 1937. The author's Herb. Two defective specimens referred to var. *macroramosum* n. v. forma, determ. by the author. A robust, c. 60 cm high plant with rather long branches at the leaf-axils from below the middle of the stem. The height is doubtful as

Fig. 5. *Hieracium demissum* (Strömf.) Dahlst. var. *macroramosum* n. var. (Author's Herb.) From Þingvellir, SW. Icel. A new variety. — $^4/_9$ natural size.

Fig. 6. *Hieracium demissum* (Strömf.) Dahlst. (Author's Herb.) From Brúarland in Mosfellssveit, SW. Icel. An intermediate form between the type and the new variety. — $^4/_9$ natural size.

Fig. 7. *Hieracium demissum* (Strömf.) Dahlst. var. *macroramosum* n. var. forma. (Author's Herb.) From Álftanes, SW. Icel. Two of the median stem-leaves. — $^{4}/_{3}$ natural size.

the terminal head together with the uppermost part of the main stem is lacking. No radical leaves. 7 stem-leaves, of which 4—5 of the lower ones are large, long-petiolate to narrow-based with unusual dentation in their lower half. The teeth are of different size with rather long intervals, broadly triangular to lanceolate-triangular shaped. The 2 uppermost stem-leaves are small and entire. The phyllaries somewhat narrower, and the teeth of the ligules longer than in the type. Indument of the involucres typical, but the stem and the leaves are nearly glabrous. Perhaps a new, independent form, but better material is necessary for further investigations (see Fig. 7).

(18) SW. Icel., at Kleppur, Reykjavik, I. Óskarsson, 15.7. 1952. The author's Herb. Two specimens, labelled as typical, determ. by the author. 15—25 cm high plants with 3 radical leaves and 3 stem-leaves entire – subentire. Two heads, but one of the two specimens has a short branch from the uppermost leaf-axil. Involucres with scattered, pilose hairs about the base and on the back of the phyllaries. The base with some few glands. Styles ferruginous—yellow brown (see Fig. 2).

(19) W. Icel., Litli Botn in Hvalfjörður, Ó. Ingimarsson, 12.8. 1951. The author's Herb. Sixteen specimens, labelled forma, determ. by the author. 20—52 cm high plants, rather slender, mostly without radical leaves and with 4—7 cauline, which are more regularly placed on the stem than usually. In other respects almost typical.

(20) W. Icel., between Reykholt and Grímsstaðir, S. O. F. Omang, 26.7. 1936. Naturh. Riksmus., Stockh. Three specimens, labelled as typical, determ. by Omang. 25—30 cm high, slender plants with 1—3 defective radical leaves and with 3 rather small stem-leaves, all the leaves obscurely dentate. 3 heads, acladium 0—3 mm. Involucres slightly floccose beneath, else glabrous or with solitary, pilose hairs on the back of the phyllaries. Ligules very shortly toothed. Differs slightly from the type.

(21) W. Icel., Búðir in Snæfellsnes, H. Jónsson, 22.7. 1897. Bot. Mus., Copenh. Two specimens with undeveloped heads, labelled f. *magis pilosa*, determ. by Dahlstedt. Revised by Omang 1936 who labelled it *H. demissum* (Strömf.) Dahlst. forma (?). These specimens *do not belong to H. demissum*. The plants are 33 cm high with no radical leaves and 8—9 stem-leaves whose upper surface in the lower part of the stem is rather densely and shortly pilose, but *only* on the left specimen on the sheet. The phyllaries of this specimen are also distinctly clothed with pilose, stellate and glandular hairs. The specimen to the right has shortly pilose involucres, which are unmistakably microglandular. The latter specimen should be referred to a form of *H. acidophorum* Om., but the other is a *Dovrense*-species, which seems to be allied to *H. phrixoclonum* Om. Probably this is a new form or a new, undescribed species.

(22) N. Icel., Hraun in Fljót, Ó. Davíðsson, 11.8. 1897. Náttúrugripasafnið in Reykjavík. Two specimens with undeveloped heads, determ. by Ó. Davíðsson (?). Labelled as *H. demissum* Elfstr.[1] f. *globulosa*. Most probably the finder has made here a clerical error in labelling. The name f. *globulosa* should be f. *glandulosa*. These specimens differ essentially from *H. demissum*, as they have rather densely glandular pedicels and involucres, and the margins of the phyllaries are conspicuously floccose. The species in question is doubtless closely allied to *H. phrixoclonum*.

(23) N. Icel., Hof at Eyjafjörður, Ó. Davíðsson, 20.9. 1897. Náttúrugripasafnið in Reykjavík. One specimen, labelled f. *pilosa*, determ. by Dahlstedt (?). The plant is 38 cm high, without radical leaves and with 5 subentire stem-leaves. 3 heads on very slender and flexuous peduncles. Phyllaries floccose with scattered glands, which are fairly numerous towards the base. Styles nearly black. The indument of the involucres and the almost black styles show clearly that this specimen *cannot be referred to H. demissum*. It is undoubtedly *H. phrixoclonum*.

(24) N. Icel., Þrastarhólsárgil[2] at Eyjafjörður, S. Stefánsson, 31.7. 1897. Náttúrugripasafnið in Reykjavík. One defective specimen, determ. by Dahlstedt, who has written on the label: "Trol. grof form af *H. demissum*. var. *glandulosa*." The upper part of the plant is lacking, but it is evident that the stem has been very high. The lower leaves are exceedingly long, finely and distantly denticulate. No radical leaves. This specimen is *not at all* referable to *H. demissum*. It is probably closely allied to *H. phrixoclonum*.

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[1] *H. demissum* Elfstr. should be *H. demissum* (Strömf.) Dahlst.

[2] = Þrastarhólsárgljúfur.

All the material discussed above has been examined by the author. It includes all findings hitherto determined as *H. demissum* (with the exception of the specimen(s) from Innra Leiti, see Chapter III, p. 58). In the descriptions of the specimens from the different localities I have emphasized the instable characters, whereas the stable characters have only been mentioned when these differ from the usual ones, as for instance the colour of the styles or dentation of the ligules. Typically the ligules are equally and shortly toothed and the styles are yellow brown or light brown.

III. Original Description.

H. demissum was first described by Strömfelt as a subspecies of *H. dovrense* Fr., which has been found in Scotland and Norway. He gives the following description: "H. foliis H. silvatici calathiis H. dovrensis simili, calathio terminali sessili et ita inferiore quam proximo" (Strömfelt 1884, p. 106).

Later the plant was treated as a separate species by Dahlstedt and he described it in detail as follows:

"*Caulis* 14—30 cm. altus, flexuosus, sat gracilis, 2—5-folius, inferne sparsim—sat dense et longe pilosus, præcipue ad nodos, superne pilis raris—sparsis obtectus, eglandulosus. *Folia basalia* florendi tempore 0 v. 1—2, exteriora parva, ovalia, interiora rhombeo-oblonga, ± obtusa (v. breviter acuta), integra, mucronato-dentata, *folia caulina* 2—5, vulgo cito decrescentia, inferiora sat approximata, superiora ± remota, infimum ± alate petiolatum petiolo ± amplectente, ± lanceolatum v. oblongum, obtusiusculum—breviter acutum, ± integrum, proximum ± late lanceolatum (—subrhomboideum), basi angusta sensim contracta sessile et ± auriculato-amplectens, subintegrum v. rare—sparsim, ± acute angulato-dentatum, breviter acutum, interdum basi latiore panduræforme, superiora ± lanceolata—lineari-lanceolata basi ± lata, ovata amplectente, subintegra v. ad basin sparsim et acutius dentata, longe acuta, in marginibus, in petiolo et in nervo dorsali sparsim et longe pilosa, cæterum in utraque pagina fere glabra v. parce pilosa, subtus fere efloccosa. *Inflorescentia* simplex, monocephala v. 2—3-cephala, acladio 2—15 mm. longo, interdum subnullo, ramis pedicellisque mediocriter longis, ± superantibus, floccis sparsis—densiusculis, glandulis subnullis v. raris—sparsis et pilis brevibus—brevissimis basi crassa nigra, raris—solitariis v. fere nullis obsitis. *Involucra* c. 10—12 mm. longa, primarium sæpe sat latum, basi ± truncatum, cætera haud raro sat angusta (summum sæpe sat reductum), basi ovata v. subturbinata, atroviridia, nitentia, *squamis* exterioribus latis—latissimis, triangularibus-ovatis, paucis in petiolum sæpe descendentibus, laxis, ± obtusis, intermediis ± ovato-lanceolatis, in apicem obtusiusculum (—sat acutum) cito attenuatis, intimis ± virescenti-marginatis (± acutis—)

obtusiusculis, omnibus apice obscuriore v. ± vinose colorato nudis v. leviter albocomosis, in marginibus et sæpe etiam in dorso ± vinose coloratis, intimis paucis angustis subulatis, nunc fere glabris (pilis glandulisque valde reductis) nunc glandulis raris usque sparsis et pilis basi crassa nigra brevibus v. brevissimis, raris obtectis dorso marginibusque parcissime stellatis. *Calathidium* c. 40 mm. diametro, subradians, *ligulis* sat latis, anguste dentatis, stylo luteo-ferrugineo, fusco-hispidulo" (DAHLSTEDT 1904, pp. 60—61).

When discussing the genetical relations of this species DAHLSTEDT (l.c., pp. 62—63) says: "Unter den *Dovrensia* kommt diese Sippe solchen Formen wie *H. chrysostylum* LBG. und Verwandten aus Skandinavien am nächsten. Sie scheint auch in enger genetischer Beziehung zu einigen Sippen aus Schottland zu stehen."

As regards the Scottish species DAHLSTEDT presumably means species found in Shetland, i.e. *H. pulchelliforme* (W. R. LINT.) PUGSL., *H. zetlandicum* (ZAHN) BEEBY and *H. australius* (BEEBY) PUGSL. Previously these were occasionally identified as subspecies or varieties of *H. demissum* (ZAHN 1921, p. 855, and PUGSLEY 1948, p. 224).

I should like to point out that concise descriptions given in the floras of Iceland (STEFÁNSSON 1924, OSTENFELD and GRÖNTVED 1934) are abstracts of this original description, and were not based on personal observations.

Obviously DAHLSTEDT based his description on exsiccatae from 5 localities, viz. Árbær, Ásgautsstaðir, Búðir, Innra Leiti and Þrastarhólsárgljúfur. Judged by his remarks the descriptions were of specimens mainly from the two first-named localities, as the specimens from Búðir, and probably also from Þrastarhólsárgljúfur, had undeveloped flowerheads. However, his remarks indicate that the specimens from Þrastarhólsárgljúfur were also partly taken into consideration. He writes as follows: "Am kräftigsten tritt die Drüsenbekleidung bei Exemplaren aus Þrastarhólsárgljúfur hervor, ohne dass andere Merkmale gleichzeitig geändert worden sind." Further: "Individuen von den übrigen Lokalitäten (Búðir and Innra Leiti) sind sowohl an den Kopfstielen als an den Hüllen mit etwas kräftigeren und reichlicheren Drüsen bekleidet" (DAHLSTEDT l.c., p. 62). Here the author must refer to the specimens from Innra Leiti[1], since the involucres on one of the two specimens from Búðir

[1] Unfortunately I have not seen the specimen(s) from Innra Leiti as they have not been found in the botanical museums where the Icelandic exsiccatae have been

have no glands and those on the phyllaries of the other specimen are very small and obscure.

As to the variability of the material in question, DAHLSTEDT (l.c., p. 62) states: "Die von mir zu dieser Sippe geführten Formen sind freilich von einander etwas verschieden." Therefore it seems probable that DAHLSTEDT was aware of the fact that he examined heterogeneous specimens which he could not differentiate because of insufficient material, but it is quite astonishing to note how well his original description applies to *H. demissum*.

In addition to the material that was available to DAHLSTEDT, OMANG made a new collection of *H. demissum*. He further obtained a number of good specimens of allied species for comparison. In his *H. demissum* material he found specimens from North-Iceland, which he referred to a new species, *H. phrixoclonum* OM. This species sometimes resembles *H. demissum*, but is not closely allied to it, and therefore I presume that they are not connected by intermediate forms. The chief characteristic of *H. phrixoclonum* is the indument of the inflorescence. Its pedicels and involucres are glandular and the margins of the phyllaries are floccose. Since DAHLSTEDT dealt with a mixture of these two species, he overemphasizes these characters in his description of *H. demissum*.

Typical *H. demissum* has either no glands on the pedicels and phyllaries or only solitary glands at the base of the involucres. Most frequently the stellate hairs are only found at the base of the involucres, but sometimes they are also discernible on the margins of the outermost phyllaries.

OMANG thought that the specimens from Þrastarhólsárgljúfur should be referred to *H. phrixoclonum*. I have not seen the plant on which he based his view, but only a defective specimen from the same locality. This specimen is kept in Náttúrugripasafnið in Reykjavík. The uppermost part of this specimen has been lost. Therefore, I cannot state whether it belongs to *H. phrixoclonum*, but I am able to affirm that it does not belong to *H. demissum* (see Chapter II, (24)).

About the plant from Búðir OMANG (1938, p. 58) writes: "Auch die Form von Búðir scheint einer anderen Art anzuhören." He does not discuss this further.

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kept. Considering DAHLSTEDT's own words as to the indument of the inflorescence I am of the opinion that the specimen(s) mentioned do not belong to *H. demissum*. More material is therefore desirable from this locality.

H. phrixoclonum has been found in few localities in North-Iceland and very little is as yet known about its varieties and distribution, whether or not there are intermediate forms between it and *H. demissum*. According to my own observations all atypical *H. phrixoclonum* deviate more from *H. demissum* than do the typical ones.

IV. Variability of the Species.

Authentic material of *H. demissum* discussed in Chapter II can be divided into two groups, *A* and *B*, according to the appearance of the plants. Group *A* comprises specimens of mean height or smaller. They are never robust and are without flower-branches from the leaf-axils or with short ones from the uppermost leaf-axils (or bract-axils). Group *B* comprises high and robust specimens with coarse growth and develops long flower-branches in the leaf-axils. In both groups the stem-leaves differ considerably in size, number, dentation, shape and location on the stem. On the other hand, the indument of the leaves, the inflorescence, and the aspect of the heads vary but slightly.

These characteristics are exceedingly significant when distinguishing between this and allied species.

All specimens of group *A* have been referred to the type, but I have labelled them "forma" when they deviate distinctly from the normal type. The normal type has 2—5 entire or sparingly dentated stem-leaves, almost efloccose phyllaries, few heads, glabrous—slightly pilose haired involucres and short- and equal-toothed ligules (see Figs. 2 and 3).

On the other hand, I consider group *B* to be a distinct variety — var. *macroramosum*. As intermediate forms between the two groups exist, it seems to me incorrect to raise this new variety to specific rank (see Figs. 5 and 7).

V. Distribution and Habitat.

H. demissum has been collected in 24 localities in the South-East, South, South-West and West-Iceland. Apparently it is fairly common in the area between the river Ölfusá and the fjord Hvalfjörður, but elsewhere it grows only sporadically. At Hornafjörður, on its eastern boundaries, it has been found in 3 adjacent localities. In West-Iceland where it occurs in two localities, its northernmost limit lies at Reykholt (see the Map, Fig. 1).

H. demissum always prefers sheltered places; low grassy slopes, lava cavities and heaths are its favourite habitats. Rarely it is found in copses. It grows exclusively in the lowlands, rarely higher than 120 m above sea level. It flowers relatively early; the time of flowering extends from about 10 July to 10 August. Therefore, it can certainly develop fruits, but apparently its seeds disperse very slowly as seen from the fact that only few specimens can be found in each locality.

VI. Discussion on Systematic Position and Origin.

From the beginning *H. demissum* has been referred to the Section *Alpestria* and the Series *Dovrensia*. This is a characteristic and distinct species, especially characterized by the inflorescence and the insignificant clothing of the involucres. In these characters it resembles the Series *Subfoliosa* and I am in fact of the opinion that it belongs to that Series. It seems to be most closely related to the Scottish species *H. breve* Beeby and *H. australius* (Beeby) Pugsl. (Pugsley 1948, pp. 224, 226).

It lies outside the scope of this paper to discuss the origin of the Icelandic *Hieracium* flora in general, but on account of my following remarks on *H. demissum*, I should like to point out that in the opinion of Omang and Dahlstedt the main part of the Icelandic *Hieracium* species has arrived from Scandinavia, the British Isles and the Faeroes during the post-glacial period and especially during the colonization of Iceland. In their opinion only few species kept their original features, but the majority changed to new forms which we now consider as endemic species for Iceland.

Omang (1938, p. 4) writes: "Es muss indessen bemerkt werden, dass mehrere isländische *Hieracium*-Arten so wenig von entsprechenden skandinavischen Arten sich unterscheiden dass es gar nicht ausgeschlossen scheint, dass sie gleichzeitig mit der Einwanderung der Norweger, in der 'Landnáms'-Zeit, und späterhin zu Island hereingekommen sein dürfen und somit im Verlaufe der historischen Zeit ihre schwache Eigenart ausgebildet haben können."

I am in agreement with Omang that *Hieracium* species arrived in Iceland during the time of the colonization, but I think these were few and apply only to those Icelandic species that are identical with or nearly identical with their ancestors in Norway and the British Isles, viz. *H. stictophyllum* Dahlst., *H. anglicum* Fr. var.

vestmannaënse Om. and *H. Stewartii* (F. J. Hanb.) Roffey var. *vikense* n. var. (the last one unpublished). All the true species grow in the British Isles (Pugsley 1948, pp. 68, 251, 253), and probably they have been carried from thence to Iceland.

In Iceland the distribution of *H. demissum* corresponds almost exactly with that of *H. stictophyllum* and *H. anglicum* var. *vestmannaënse*. However, *H. anglicum* has not been found in as many localities as the others.

It is worthy of note that in Vestmannaeyjar (Vestmanna Isles) and Mýrdalur, where *H. anglicum* var. *vestmannaënse* is most common, *H. demissum* grows in close vicinity of this species. With the exception of these two, no *Hieracium* species have been found in Vestmannaeyjar (the author has had no opportunity to visit the isles, and further investigations seem desirable).

H. demissum is certainly different from other allied British species, but not in essentials. It cannot be excluded that it has originated from them 12 centuries ago: as previously mentioned, its tendency to vary is considerable. The well-known German hieraciologist K. H. Zahn (1921, p. 855) identified the Shetland species *H. pulchelliforme* as variety and *H. zetlandicum* as subspecies of *H. demissum*.

This evidence seems to support the conclusion that *H. demissum* originated in the British Isles, probably in Shetland, and was carried from there to Iceland during the period of colonization, contemporaneously with *H. anglicum*.

Taking the limited distribution of *H. demissum* into consideration, it seems improbable that the species immigrated to the country during earlier times, i.e. prior to the colonization.

VII. Conclusions.

1. All specimens from North-Iceland and from Búðir in West-Iceland, which were formerly identified as *H. demissum* (Strömf.) Dahlst., do not belong to this species. They must be referred to *H. phrixoclonum* Om. or other more distantly related species. Intermediate forms between *H. demissum* and *H. phrixoclonum* have as yet not been found and I consider it improbable that they exist.

2. *H. demissum* is a fairly variable species from which I have separated a variety described as new, viz. var. *macroramosum* (see p. 51).

3. All herbarium specimens of *H. demissum*, which have been labelled forma or var. *glandulosa* or *globulosa* (?) (nomen nudum), are partly synonyms of *H. phrixoclonum* Om. and should be omitted. We also find a few specimens which are labelled f. *pilosa*, when involucres and pedicels are more pilose than usual. The name of this forma was taken from Dahlstedt's remarks on the labels of *H. demissum*. On one label he wrote f. *parce pilosa* and on the other, f. *magis pilosa* (see Chapter II).

In future the name f. *pilosa* should be kept for *H. demissum*, when the involucres and especially the pedicels are unusually strongly pilose. This forma can be described as follows: Pedunculi squamaeque pilis numerosis vestiti. Aliter ut in typo.

4. The material, which was available to Dahlstedt, when he wrote his original description of *H. demissum*, comprised a few defective and dissimilar specimens which he referred to this species, but they belong to species at that time unknown.

On account of this his description does not fully agree with the appearance of the typical *H. demissum*, mainly as to the indument of the inflorescence (see Chapter II).

5. The distribution of *H. demissum* extends from Eystra Horn along the south and west lowlands (including Vestmannaeyjar) and northwards to Reykholt in Borgarfjörður. The species occurs in 5—120 m height above sea level. Its habitats are sheltered grassy and heathery localities (see the Map, Fig. 1).

6. Hitherto *H. demissum* has been classified as belonging to section *Alpestria* and Series *Dovrensia*. In my opinion it is more closely allied to the Series *Subfoliosa*, and it is actually so distinct that I regard it justifiable to refer it to a new Series of the Section *Alpestria*.

7. *H. demissum* is an endemic species in Iceland and most closely allied to Shetland species. Most probably it has descended from them during the time of Iceland's colonization. As previously mentioned it seems evident that *H. demissum* is able to produce varieties with a different appearance, and it seems reasonable to suppose that dissimilar environmental conditions have induced these variations with the result that the species is now fairly distinct from its ancestors.

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WHAT IS ERIOPHORUM CHAMISSONIS C. A. MEYER?

BY

MARCEL RAYMOND.

(Montreal Botanical Garden, Canada.)

Each species of *Eriophorum* has an intricate story attached to its name and all the monographical treatments, either on a world or a regional basis (Andersson 1849, 1857; Nylander 1852; Meinshausen 1900; Fernald 1905, 1925, 1950; Lindberg fil. 1906; Blomgren 1926; Juzepczuk 1935; Vassiliev 1940; Hultén 1927, 1937, 1942; Ohwi 1944), have so far exhibited strongly divergent views.

The main reason is historical. Many of the old authors, failing to pay sufficient attention to the vegetative characters, have burdened the botanical literature with incomplete and inaccurate descriptions which, nevertheless, must be taken into account. Furthermore, many circumpolar species have been described in Asia, in North America and in Europe under different names. *E. Scheuchzeri* Hoppe (1800) was redescribed as *E. capitatum* Host (1801), and again, from Labrador as *E. leucocephalum* Boeckl. (1858). Prior to Seidenfaden and Sørensen's clever *mise au point* (1933), *E. callitrix* Cham. meant to Scandinavian botanists *E. brachyantherum* Trautv. & Meyer, and to American florists the actual *E. vaginatum* ssp. *spissum* (Fern.) Hultén. As to true *E. callitrix*, though accurately described and beautifully illustrated by Chamisso, and ranging from Siberia to Baffin and eastern Greenland, it became more or less a lost species.

E. brachyantherum itself was described from Siberia, by Trautvetter and Meyer in 1856 and, a few months later, as *E. vaginatum* **opacum* by Björnström with material from Lapland, while Fernald (1905), overlooking Trautvetter and Meyer's older specific name, made the unnecessary transfer *E. opacum*.

If we turn now to *E. Chamissonis* C. A. MEYER, the situation is even worse, so much so that HYLANDER (1945), as did TRAUTVETTER (1877), termed this taxon: *nom. confus. et ambig. rejic.*, a judgment to which the present author does not subscribe. As we will proceed with the discussion, we shall find *E. humile* TURCZ. and *E. Chamissonis* β *humile* TURCZ. and *E. vaginatum* var. *humile* (TURCZ.) NYLANDER involved, and the whole nebulous enough to be dealt with in another paper.

Eriophorum Chamissonis C. A. MEYER appears for the first time in LEDEBOUR's *Flora Altaica* (1829, pp. 70—71) in the following terms:

a) Spica solitaria

1) *Eriophorum Chamissonis* C. A. MEYER

E. culmis solitariis teretibus, cum foliis compressis laevibus, vaginis parum inflatis, spica oblonga, antheris linearibus.

E. intermedium CHAMISSO *in litt.* (nomen mutandum erat, cum jam sit *E. intermedium* BAST.) *E. capitatum* HOFFM. differt spica breviore et inprimis antheris brevibus cordato-ellipticis. Magis recedunt *E. vaginatum* L. et *E. callitrix* CHAM. culmis caespitosis, foliis serrulatis aliisque notis.

Planta glaberrima, laevissima. Radix repens hinc inde protrudit culmos solitarios, semipedales vel fere pedales. Folia linearia, subcompressa, obtusa. Spica oblonga, multiflora. Glumae uninerves, acutiusculae, acutae vel acuminatae. Stamina 3. Antherae lineares, lineam longae. Stigmata 3 vel 4. Caryopsis laevissima; nitida, oblonga, compresso-tetragona vel compresso-trigona. Lana longissima, alba (in specimine unalaschcensi rufa).

Hab. in alpibus circa fontes fl. Uba (L.); in insulis fl. Tschuja, nec non in palude alpina ad desertum editum juxta fl. Tschuja (B.) Fl. aestate ♃.

Both rivers are located in the Altai region, where the specimens were collected in 1826. If we consult LEDEBOUR's preface, we read that "Quo factum est, ut per aestatem anni 1826 circiter 1600 phanerogamarum species a nobis colligerentur, in hoc opere recensendae". The collectors are LEDEBOUR (L.) and BUNGE (B.), but the last four words in the third paragraph ["Lana longissima, alba (in specimine unalaschcensi rufa")] indicate that more than one plant are implied.

Through the courtesy of the Curator of the Herbarium of the Komarov Institute (Leningrad), I obtained a photograph of the "Altai element". Duplicates of the collection are also in the GRAY Herbarium, the British Museum of Natural History and the Muséum

d'Histoire Naturelle de Paris; it is a reduced alpine form of *E. vaginatum* L., which NYLANDER treats as var. *humile* (Fig. 1).

ADALBERT LUDWIG VON CHAMISSO (January 27, 1781—August 21, 1839), born in Boncourt, Champagne (France), made himself a reputation both as writer and botanist. Together with JOHANN FRIEDRICH VON ESCHSCHOLTZ, he accompanied KOTZEBUE, in 1816–1817, on the world-round trip aboard the Rurik. He worked in Unalaska for 104 days (HULTÉN 1940); among the plants collected there was also a species of *Eriophorum*, but a stoloniferous one, of which MERTENS collected also a specimen in Kamtchatka, in 1827–1828.

About that time, C. A. MEYER was preparing the treatment of the *Cyperaceae* for LEDEBOUR's Flora Altaica. CHAMISSO sent MEYER his description (and probably his specimen, as there is none presently in CHAMISSO's herbarium in Halle), so as to insert it in the *Flora Altaica*, as both thought that there was only one species involved. In those days, botanists had not realized as yet the importance of vegetative characters in *Eriophorum*. CHAMISSO used *E. intermedium* to term his new species.[1] But, as there was already in existence an *E. intermedium* BASTARD, MEYER took upon himself to substitute in its stead *E. Chamissonis*.

As a first step in the discussion, we may say that *E. Chamissonis* C. A. MEYER (in *Flora Altaica*, 1829), though described as "radix repens . . .", applies to a caespitose plant from Altai, with an incidental reference to a stoloniferous specimen from Unalaska.

MEYER had, already in 1825, submitted for publication to the editorial committee of the *Mémoires des Savants Etrangers de l'Académie St Pétersbourg* a paper entitled "Cyperaceae Novae VII", in which he furnished a more detailed description of *E. Chamissonis* as well as an accompanying plate.

Fortunately, it was published only in 1831, two years after the *Flora Altaica*; otherwise, *E. Chamissonis* would have fallen into the synonymy of *E. vaginatum* L. It also gave MEYER (pp. 204—205) the opportunity to add MERTENS' specimen from Kamtchatka.

Eriophorum Chamissonis M. Tab. III.

E. culmis solitariis teretibus foliisque compressis laevibus, vaginis parum inflatis, spica solitaria oblonga, antheris linearibus.

[1] However, the label bears *Er. dubium* CHAM. in CHAMISSO's own handwriting. According to Index Kewensis, there are also *E. dubium* HEGETSCHW. (1840) and *E. dubium* STEUDEL (1855), both of doubtful application.

Erioph. intermedium Cham. in litt.

Radix valde repens et hinc inde culmos solitarios emittens.

Culmi crassitie fili emporetici, teretes, molles, striati, caeterum laevissimi et glaberrimi, basi vaginis foliiferis tecti, superne nudi; florentes sex pollices circiter alti, fructiferi pedales vel altiores.

Vaginae sex vel septem glabrae, striatae; inferiores rufescentes fissae, superiores duae connatae, summa longissima, vix inflata, apice sphacelata, vel omnino mutica, vel foliolo bilineari terminata.

Folia linearia, compressa, basin versus dorso convexa facie canaliculata, obtusa, glabra, laevissima.

Spica multiflora, solitaria, terminalis, oblonga, florens (lana destituta) sex lineas longa, duas circiter lata, spatham ovato-lanceolatam tri- vel quinque nervem longe superans.

Glumae undique imbricatae, lanceolatae, acutae, glabrae, uninerves, nigricantes, margine albido scarioso cinctae.

Stamina tria. Filamenta capillaria, alba. Antherae lineares, lineam fere longae, flavae.

Germen glabrum, ellipticum. Stylus glaber. Stigmata tria vel quatuor, villosula.

Caryopsis oblonga, mucronata, basi attenuata, compresso-tetragona aut trigona, glabra, laevis.

Lana copiosa, laevissima, in specimine fructifero pollicem superans, rufa (an semper?).

Habitat in Kamtschatka et Unalaschka, nec non in alpibus Altaicis. ♃.

Er. capitatum Hoffm. differt spica subrotunda spatham aequante nec non antheris brevibus cordato-ellipticis. *Er. vaginatum* L. et *Er. callitrix* Cham. recedunt culmis caespitosis, foliis serrulato-scabris aliisque notis indicatis.

Cum jam alia *Eriophori* species nomine *intermedii* a cl. Bastardio designata sit, nom. a cel. Chamisso huic speciei impositum, mutavi.

As a second step in the discussion, we may say that *Eriophorum Chamissonis* C. A. Meyer (in Cyperaceae Novae, 1831) designates a stoloniferous species based on two specimens, one collected by Chamisso in Unalaska (Fig. 2), and the other "Ad fretum Seniaviss (?)" (in Kamtchatka) by Mertens (Fig. 3), with a slight allusion to the species being present also in the Altai region.

Some modern authors reject *E. Chamissonis* C. A. Meyer in favor of *E. medium* Anderss. (1857), a name also in need of investigation. Mr. Carl G. Alm (Uppsala) was kind enough to provide me with an English translation of Andersson's Swedish commentary on his new species (pp. 62—63).

E. medium: culmis subsolitariis, stolones breves emittentibus; spica virginea oblongo-obovata, squamis subulato-cuspidatis, latitudine basis sexies

Fig. 1. *E. Chamissonis* sensu "Flora Altaica" (= *E. vaginatum* var. *humile*).
Fig. 2. Type specimen of true *E. Chamissonis* collected by Chamisso in Unalaska (the label in his own handwriting).
Fig. 3. Type specimen of true *E. Chamissonis* collected by Mertens in Kamtchatka.

Fig. 4. Type of *E. russeolum* Fr. from Karesuando (Lapland).
Fig. 5. Type of *E. Chamissonis* β *elongatum* Turcz. from the Lake Baikal area (*E. russeolum* Fr.).

longioribus, totis opacis; antheris oblongis, filamentis quadruplo brevioribus; spica lanigera obovato-hemisphaerica; lana pallide rufescente.

Growing in pools and swamps in Lappland. It was collected by me near Quickjock in Luleå Lappmark.

I am very doubtful whether or not this plant deserves to be placed as a species among the others. I have entered it hoping that it may attract attention. With respect to the tall, narrow culm, often lacking basal leafy stolons, the elongated flower-head, of which the scales are gradually tapering and of which the wool at ripeness is widely broom-shaped, it seems to have something in common with *E. vaginatum*. There is no doubt that it is closely allied to the next species [i.e. *E. capitatum* Host] (which as both Fries and Hartman declare sometimes has reddish wool), and perhaps it would be more correct to regard it as a subspecies of *E. capitatum*. However, it is distinguished by its much taller and slender culms, by its generally broader and flatter leaves, by its inner scales, which are more acuminate, longer and without scarious margins, and finally by the reddish wool, which is formed as a more elongated head, dilated at the top. If *E. callithrix* [i.e. of Scandinavian authors of the time = *E. brachyantherum* Trautv. & Meyer] is to be regarded as a link between *E. vaginatum* and the other species of the mountains, in some degree, this is the case with this variety but in relation to *E. capitatum*.

As Nylander has shown already, *E. Chamissonis* C. A. M. is composed of two varieties, of which one belongs to *E. capitatum*, the other to *E. vaginatum*. It appears quite possible, that the first name is a synonym for *E. medium* (C. A. Meyer, Cyp. Nov. VIII t. 3); nevertheless, lest it should lead to misunderstanding, I would not use the denomination by Meyer, and instead of it I have chosen a more convenient one. Concerning the other variety of *E. Chamissonis* (C. A. M. in Ledeb. Fl. alt. I p. 70 — *E. humile* Turcz. in Hb. Ac. Petr.) this is, as I have had the opportunity of being convinced through studies in the herbarium of Prof. Fries, nothing but a variety of *E. vaginatum*, which, removed from the swamps to the firm ground of the mountains, has been dwarfed.

The above text clearly shows that Andersson discards *E. Chamissonis* C. A. Meyer as a confusing name, on account of the two elements involved. It shows also that he believed that *E. Chamissonis* (his *E. medium*) existed also in Scandinavia and in adjacent northern Russia. However, true *E. Chamissonis* ranges only from eastern Asia, across continental Canada, to northern Newfoundland.

In a long answer to Theodore Holm (1906), who protested against the replacement of *E. russeolum* Fries by *E. Chamissonis* Meyer, the late Professor Fernald (1906) contributed a long and scholarly discussion of the problem, summarized in 9 numbered paragraphs. I question his paragraph 6, which reads (p. 64):

> There are only two repent plants with solitary culms concerned in the question of the identity of *Eriophorum Chamissonis*. One is *E. Scheuchzeri*

(*E. capitatum*) with which your correspondent, following a statement of Fries rather than the original description and the clear plate of Meyer, would associate it. The other is *E. russeolum*, Fries, which, before he had seen the Altai element of *E. Chamissonis*, Fries himself recognized as unquestionably the plant meant by Meyer, saying in a discussion of *E. Chamissonis* with "spica oblonga" and "antheris linearibus" from Lappland: "*Reliquis nominibus nondum divulgatis E. russeolum diximus, quod vero nomen lubenter alio publicato supprimimus, ne inutilis synonymia augeatur.*"

Professor Fernald's errors were to infer that there were only two repent plants with solitary culms and to ignore a later statement of Fries in which he revived his *E. russeolum*. If we except *E. Scheuchzeri* Hoppe and *E. altaicum* Meinsh., which we shall discuss in another paper, there are five taxa involved:

1. In Iceland (Löve 1948), Scandinavia and adjacent Russia, eastward to approximately the mouth of the Ob river in the north and Lake Baikal in the south, as well as in Atlantic North America, from Fort Chimo (*c.* lat. N. 58°) to Nova Scotia, thrives a stoloniferous and slender species of *Eriophorum* with narrowly triangular spikes, brown bristles, fertile scales with a broad hyaline margin, and smooth akenes. This species is known in European literature as *E. russeolum* Fries. Most American botanists, following Fernald, erroneously call it *E. Chamissonis* C. A. Meyer. For the sake of clarity, we will temporarily refer to it as **Taxon number one.**

2. There is a white phase which may well be a species in its own right, since it is circumpolar or almost so, quite abundant in southern Alaska, and reaches the eastern Canadian Arctic. It is known in European literature as *E. russeolum* var. *albidum* F. Nylander, *E. russeolum* var. *leucothrix* (Blomgr.) Hultén, while Fernald's last treatment in Gray's Manual (8th ed.) accepts it as *E. Chamissonis* f. *albidum* (F. Nylander) Fern. This, in the present discussion, will be termed **Taxon number two.**

3. There is also a variety with hispidous akenes. It occurs mainly in the Pacific region: boggy marshes of Manchuria and the adjacent Amur region, Korea, Japan and the Sacchalines, jutting out in Kamtchatka, then following the Aleutian Islands to end in southern coastal Alaska. But it has two remote outposts: one at the mouth of the Ob river, in northwestern Siberia, the other in northeastern Ungava, Quebec. It is a plant quite close to, but still distinct from, typical *E. russeolum*, just as slender though a trifle stiffer. In color, the bristles are usually deep brown, sometimes Isabella, and rarely

white. This plant is termed by KOMAROV, MEINSHAUSEN and NAKAI as *E. mandshuricum* MEINSH., while OHWI and others treat it as *E. russeolum*, and MIYABE & KUDO (1930–31) as a species of their own: *E. strigosum*. This quite characteristic plant will be our **Taxon number three.**

4. From Kamtchatka and easternmost Asia, along the Aleutian Chain and then to Alaska, where it is very abundant, down the Pacific coast southward to Vancouver Island, Washington, then inland to the Rockies, Colorado, Wyoming, Idaho, Alberta, Minnesota, the James Bay region, then thinning out to northern Newfoundland, occurs still another species. It is an unusually coarse plant with a prominent sterile basal scale, fertile scales provided with a narrow hyaline margin, and the fruiting head largely globose. The bristles are usually pale brown but there is a white-bristled form which does not seem to have an area of its own. This plant is known in literature under different names: *E. Chamissonis* MEYER, *E. Scheuchzeri* var. *Chamissonis*, *E. medium* ANDERSS., *E. Chamissonis* var. *aquatile* (NORMAN) FERN. This will be our **Taxon number four.**

5. Finally, in northern Scandinavia and adjacent Russia, eastward to approximately the mouth of the Yenisei, is a species with bristles ranging in color from brown to white, and clearly intermediate between *E. Scheuchzeri* and *E. russeolum* combining in different degrees the coarseness and the slenderness of either, with anthers somewhat intermediary in length too. Though not investigated experimentally, it looks very much like a hybrid between the two aforementioned species. It is found in literature under *E. Chamissonis* C. A. MEYER, *E. medium* ANDERSS., *E. rufescens* ANDERSS., *E. aquatile* NORMAN, *E. intercedens* LINDBERG. This, as only incidental to the discussion, will stand as our **Taxon number five.** Now, we have a taxonomical picture of the five elements involved. Without their detailed history, it would have been impossible to get a complete picture of the group.

1. Even if, because of the difficulties involved by the then poorly understood *E. Chamissonis* C. A. MEYER, FRIES changed his mind several times about it, *E. russeolum* FRIES has a solid basis. I have attempted to relate the whole story in discussing ×*E. Pylaieanum* (RAYMOND 1951). A picture of the type kindly provided by Dr. AARNO KALELA, Director of the Botanical Institute of Helsingfors,

Fig. 6. Illustrations of (1) *E. Chamissonis*, showing a fruiting head and the scale (*a*); of (2) *E. russeolum*; and of (3) *E. russeolum* var. *majus* showing also (*b*) the hispidous akene. — Del. Mme Carmen Poulin.

shows the slender plant Scandinavian and northeastern American botanists are familiar with (Fig. 4). I have added also a picture of *E. Chamissonis* β *elongatum* Turcz., from Lake Baikal, another synonym of *E. russeolum* Fries (Fig. 5).

2. The white-bristled taxon has been termed lately *E. russeolum* Fr. var. *leucothrix* (Blomgr.) Hultén. But there is an older name

which seems perfectly valid: it is NYLANDER's var. *albidum*. It had been rejected by BLOMGREN (in Bot. Not. 1926) who assumed that the name applied to the albino of both species; meanwhile, Dr. FERNALD has added to the confusion in making the transfer *E. Chamissonis* var. *albidum*, thus lumping two species and transferring the albinos of one to the other species and furthermore recognizing true *E. Chamissonis* but only as var. *aquatile*, a later synonym of ×*E. medium* (*E. russeolum* × *E. Scheuchzeri*).

There is no reason for transferring var. *albidum* to *E. Chamissonis* and to create another taxon for the albino of *E. russeolum*, as NYLANDER's name is perfectly clear (p. 10):

> ***E. russeolum***
>
> — **albidum**, culmo gracili elongato, foliis filiformi-convolutis subtrigonis, squamis lineari-lanceolatis, lana albida.
>
> Hab. in insula Kodjak ad litus Americae bor. occidentalis. Vidi in Hb. Ac. Sc. Petr.

The map shows that it is more than a variety, its area being circumpolar, while typical *E. russeolum* is more or less oceanic. Another striking feature in its distribution is that, while the typical plant does not reach the eastern Canadian Arctic, its var. *albidum* does. It appears as though the variety were the biological type, from which the two rufous-bristled forms were derived later and moved southward. This would be another instance where actual taxonomy goes against biological facts.

3. As to our taxon number three, i.e. the slender "*russeolum*" with hispidous akenes, concentrated mostly in the Pacific area, though its area apparently has homogeneity, it is better treated as a variety, the oldest valid name being var. *majus* SOMMIER (1896). The two outposts shown on the map (Fig. 7), one at the mouth of the Ob river, the other in northernmost Quebec–Labrador frontier, may well be remnants from a somewhat wider distribution; or they may show that the hispidous akenes are among the possibilities of the species and may appear in any of its population. It is for that reason that I have refrained from treating it as a subspecies. It is probably a race.

4. The tall plant collected by CHAMISSO and described by him, though bearing MEYER's signature, must correctly be called *E. Chamissonis* C. A. MEYER. Its continental distribution shows it to be a species which, like *Schizachne striata* (MICHX.) HULTÉN, *Carex spaniocarpa* STEUD., *Carex viridula* MICHX., ranges from easternmost

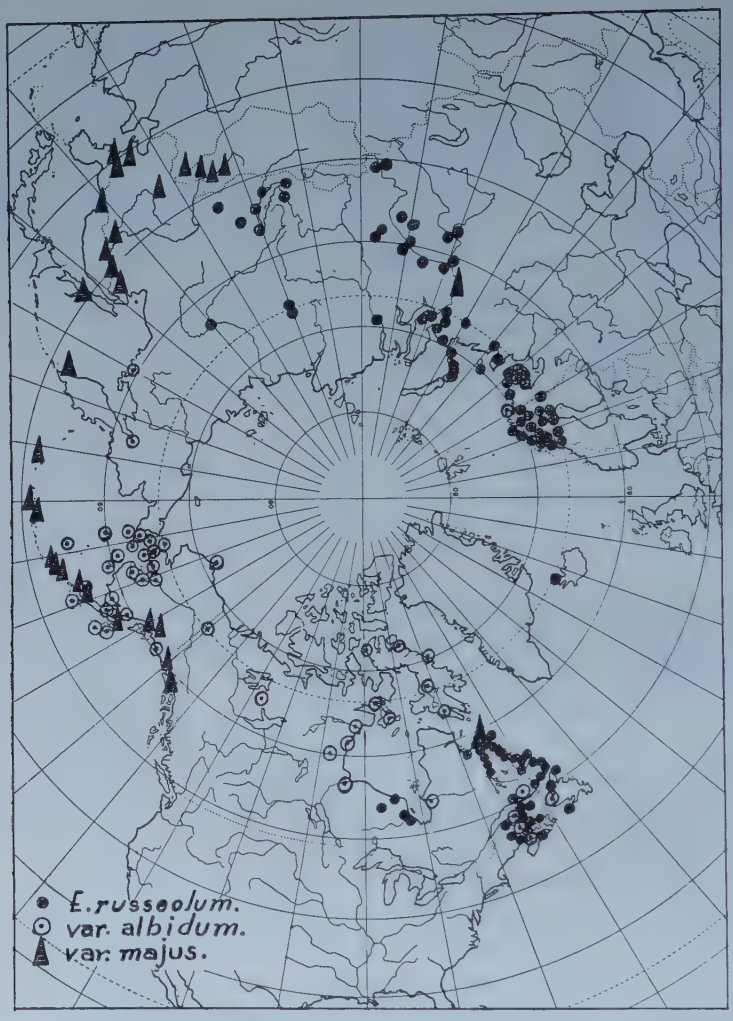

Fig. 7. Distribution of *E. russeolum* Fr. and its two varieties.

Asia across northern North America (Fig. 8). The albino (still without a name) has no area of its own.

5. Finally, I would deem it feasible, unless some one more versed thinks otherwise, to reserve ×*E. medium* Anderss. for the plant of northern Scandinavia and adjacent Russia more or less intermediary (and presumably of hybrid origin) between *E. russeolum* Fr. and *E. Scheuchzeri* Hoppe.

The following key and treatment, even with its burdensome

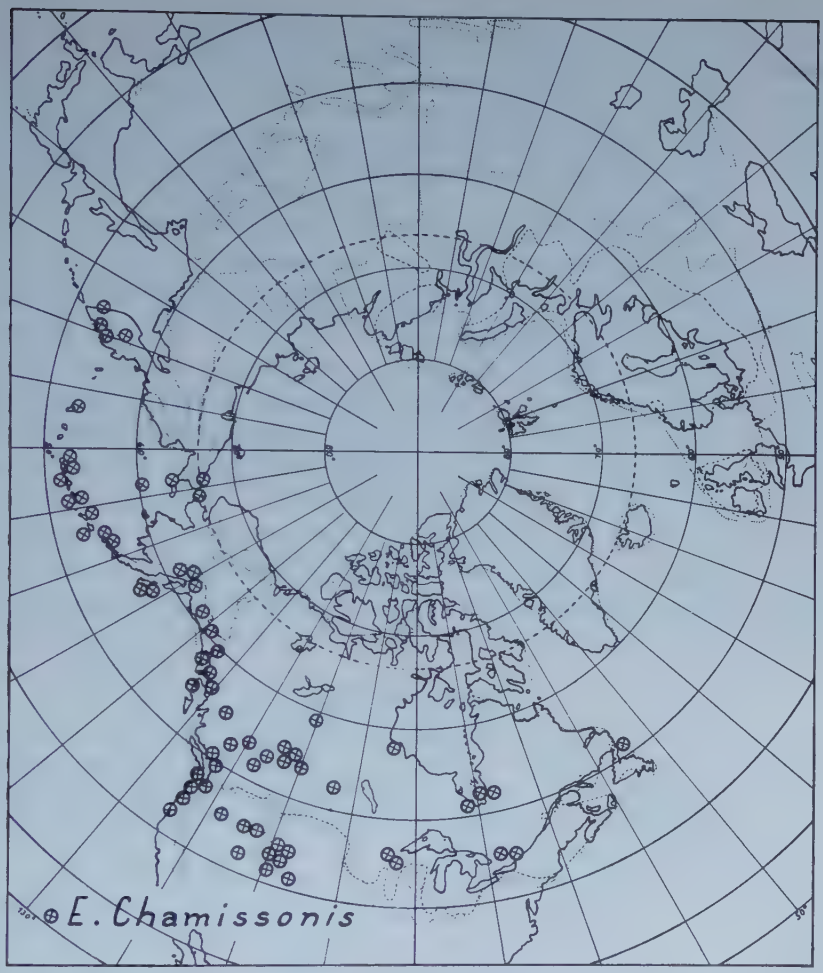

Fig. 8. Distribution of *E. Chamissonis* C. A. Meyer.

synonymy, will give one a better picture of the group than has been permissible during the course of the preceding laborious discussion.

Abbreviations for the different herbaria cited below are as follows (according to Lanjouw and Stafleu, Index Herbariorum, 2nd ed., 1954):

BM. British Museum of Natural History (London, England);
CAN. National Herbarium (Ottawa, Canada);
DAO. Herbarium of the Dept. of Agriculture, Exp. Farm (Ottawa, Canada);
GH. Gray Herbarium of Harvard University (Cambridge, U.S.A.);

K. Herbarium of Kew Gardens (Surrey, England);
MT. Marie-Victorin Herbarium (Montréal, Canada);
MTJB. Jardin botanique de Montréal (Canada);
NY. New York Botanical Garden (New York, U.S.A.);
P. Muséum d'Histoire Naturelle (Paris, France);
S. Herbarium of the Naturhistoriska Riksmuseet (Stockholm, Sweden);
US. National Museum, Smithsonian Institute (Washington, U.S.A.).

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Synopsis sectionum.

A. Stamina tria; glumis uninervatis; spica sola vel plures; setae numerosae longae, albae vel rufae ..... Sub-genus **Eriophorum**
B. Spica solitaria, foliis nullis involucralibus suffulta; folia caulinaria in vagina aphylla reducta ... Sectio ***Vaginata*** Andersson, Cyper. Scand. 13. 1849.
C. Plantae caespitosae; glumis basilaribus spicae vacuis 12 vel pluribus ... Sub-sectio *Multivacua* (Norman) Fernald, Rhodora, 27: 206. 1925. Sectio *Multivacua* Norman, in Christ. Vidensk.-Selsk. Forh. 16: 45. 1893.
D. Glumis basilaribus vacuis griseo-albidis demum recurvatis vel reflexis ad quam *E. vaginatum* L. (multis cum speciebus) pertinet
Series *Reflexa* Raymond, n. ser.
DD. Glumis basilaribus vacuis nigris (casu eburneis) tandem erectis ad quam *E. brachyantherum* Trautv. & Meyer et *E. callitrix* Cham. pertinent
Series *Appressa* Raymond, n. ser.
CC. Plantae stoloniferae; glumis basilaribus vacuis quam 7 paucioribus ..... Sub-sectio *Paucivacua* (Norman) Fernald, loc. cit. — Sectio *Paucivacua* Norman, loc. cit.
E. Antherae breves (0.5–1 mm longae); setae albae, ad quam *E. Scheuchzeri* Hoppe et *E. altaicum* Meinsh. pertinent ..... Series *Fernaldiana* Raymond, n. ser.

EE. Antherae longiores (1.5–3 mm longae); setae tum rufae tum albae, ad quam *E. Chamissonis* C. A. Meyer et *E. russeolum* Fries pertinent
Series *Hultenia* Raymond, n. ser.

BB. Spiculae plures laxe aggregatae saepe nutantes bracteis foliaceis suffultae ..... Sectio ***Phyllanthela*** Andersson, loc. cit.

F. Foliis planis ad quam *E. angustifolium* Honckn. pervariabile, *E. latifolium* Hoppe et *E. viridi-carinatum* (Engelm.) Fern. pertinent ..... Series *Anderssonia* Raymond, n. ser.

FF. Foliis trigono-canaliculatis, ad quam *E. gracile* W. D. J. Koch, *E. tenellum* Nutt. et *E. coreanum* Palla pertinent
Series *Pallaeana* Raymond, n. ser.

AA. Stamen unicum; spiculae dense aggregatae numquam nutantes; glumis multinervatis setis rufinis casu albidis, ad quod *E. virginicum* L. (et forsan *E. criniger* (Gray) Beetle, quod non vidi) pertinent
Sub-genus **Eriophoropsis** (Palla) Raymond, n. comb. — Genus *Eriophoropsis* Palla, Bot. Zeit. 54: 151. 1896.

Clavis specierum seriei *Hultenia* Raymond.

A. Plantae graciles (caulis diam. 1–1.5 mm); glumis fertilibus in parte media sola opacis, ceterum hyalinis; spica matura obovata; species oceanica.
B. Achaenia laevia.
C. Setae rufae ..... *E. russeolum*
CC. Setae albae ..... var. *albidum*
BB. Achaenia superne vestita ..... var. *majus*

AA. Plantae crassae (caulis diam. 2–4 mm) et semper robustae (4–6 dm altae); glumis fertilibus cum margine angusto hyalino; gluma basilaris triangulata et multo conspicua; spica matura rotundato-obovata; species sibirico-americana continentalis.
D. Setae rufae ..... *E. Chamissonis*
DD. Setae albae ..... f. *Turneri*

AAA. Plantae sat humiles sat crassae et intermediae inter *E. russeolum* et *E. Scheuchzeri*; spica rotundato-obovata; antheris siccis 1.2–1.4 mm longis. Occurrunt populationes cum setis variis colore.
E. Setis pallide rufescentibus..... × *E. medium*
EE. Setis rufescentibus ..... f. *rufescens*
EEE. Setis albidis ..... f. *candidum*

Eriophorum russeolum Fries, in Hartman, Handb. Skand. Fl. ed. 3: 13. 1838, in part.; Mant. III. 170. 1842, in part. excl. spec. Pylaieanum ex Terra-Nova; Andersson, Cyper. Scand. 13. Tab. II, fig. 32. 1849; Nylander, Acta Soc. Scient. Fenn. 3: 9. 1852 (Pl. I), in part. excl. spec. Pylaieanum; Steudel, Syn. Pl. Cyper. 128. 1855; Andersson, Bot. Not. 80. 1857; Hjelt, Consp. Fl. Fenn. II: 209. 1892; Blomgren, in Holmberg, Skand. Fl. 2: 294. 1926; Lindman, Sv. Fanerogamfl. 121. 1926; Hiitonen, Suomen Kasv. 135. 1933; Juzepczuk, Fl. USSR, III: 35. 1935; Nordhagen,

Norsk Fl. 118. 1940; Illustraj. fig. 361. 1948; Lid, Norsk Fl. 118. 1944; Hultén, Atlas N.W. Eur. 72. 1950. — *E. Chamissonis* Fries, Mant. II: 1. 1839; Ledebour, Fl. Ross. IV: 253. 1853, in part.; Fernald, Rhodora 7: 83. 1905, in part. excl. synonymia et specim. numer. citata; Rhodora 27: 207. 1925, in part.; Gray's Man., 8th ed. 277. 1950, in part. excl. specim. Americae Occidentalis; Lindb. fil., Sched. Pl. Finl. exs. I–VIII: 31. 1906; Roland, Flora Nov. Scot. 199. 1947. Non C. A. Meyer. — *E. dahuricum* Fisch. (in sched. in P!). — *E. vaginatum* β *medium* Læst., Loca parallela pl., Nov. Act. Ups. II: 295. 1839. — *E. vaginatum* γ *perigynii pilis fulvis* Hooker (in part.), Fl. Bor. Am. II: 231. 1839. — *E. Chamissonis* β *elongatum* Turcz., Fl. baic.-dah. II (2): 252. 1856. — *E. aquatile* Haglund, Bot. Not.: 147. 1902, non Norman.

Northern Europe: Iceland (Löve 1950); Sweden, Norway, Finland (Hultén 1950); adjacent Russia, including Novaya Zemlya (Tolmatchev & Blumenthal 1931), Waigatch and Kanine Peninsula (Andreev 1931).

Asia: Siberia: Jamal Peninsula (Kjellman 1882); mouth of Yenisei (Scheutz 1888), including Sibiriakoff Island (Tolmatchev 1931); Ob (Sommier 1896); Upper Tobol (NY!); Altai (Juzepczuk 1935); Lena-Kolyma; Angara-Sayan (US!, P! numerous sheets from the Baikal area); Dahuria (Fischer, P!); Szita distr. (NY!).

North America: James Bay; eastern Ungava (MTJB!); coastal Labrador; Saguenay Co., including Mingan and Anticosti Islands (MT!); Gaspé Co.; Magdalen Islands; New Brunswick; Nova Scotia; Prince Edward Island; Newfoundland and St Pierre et Miquelon Islands (numerous sheets in MT! and MTJB!).

var. ***albidum*** Nylander, Acta Soc. Sc. Fenn. 3: 10. 1852. — *E. Chamissonis* var. *albidum* Fernald, Rhodora 7: 84. 1905; f. *albidum* Fernald, Rhodora 23: 131. 1921; Gray's Manual, 8th ed.: 277. 1950, in part. — *E. russeolum* f. *leucothrix* Blomgr., Bot. Not.: 398. 1926; Holmberg, Skand. Fl. 2: 294. 1926. — *E. Chamissonis* f. *subalbidum* Lindberg fil., Schedae Pl. Finl. Exs. IX–XX: 26. 1916. — *E. russeolum* f. *subalbidum* Blomgr. in Holmberg, Skand. Fl. 2: 294. 1926. — *E. russeolum* var. *leucothrix* Hultén, Fl. Alaska and Yukon, II: 283. 1942.

Northern Europe: Alten Fjord.

Eastern Siberia: Northern Kamtchatka: Penshina River (Gorodkov & Tichomirov, S!); Ochotsk Sea (J. Small, U. S. N. Pacific Expl. Exp. under commanders Ringgold & Rodgers, P!).

North America: islands in the Bering Strait and Alaska; Northwest Territories; west coast of Hudson Bay, Southampton Island and Baffin Land; one locality in western Newfoundland; one in Saguenay Co. and a group of close localities in the mountains of Gaspé, Quebec; one in New Brunswick and one in Nova Scotia.

var. ***majus*** Sommier, Fl. dell' Ob infer., 103. 1896; Komarov, Acta Horti Petropoli 18: 415. 1901. — *E. mandshuricum* Meinshausen, Acta Horti Petrop. XVIII: 268. 1901; Komarov, Acta Horti Petrop. XX: 336. 1901;

Komarov & Alisova, Key Pl. Far E. Reg. USSR. I: 257, pl. 73. 1931; Nakai, T., Tjosen Sanrin, no. 90, 10. 1941 et in litt. 6.V.51. — *E. Chamissonis* Maximowicz, Prim. Fl. Amurensis, 299. 1859, non C. A. Meyer. — *E. russeolum* Hultén, Fl. Kamtch. I: 162. 1927; Fl. Aleut. 103, 1937; Fl. Alaska and Yukon, II: 283. 1942; Kitagawa, Lineamenta Fl. Mansh. 117. 1939; Ohwi, Cyper. Japon. II: 92. 1944; Porsild, Can. Field Nat. 58: 130. 1944; non Fries. — *E. strigosum* Miyabe & Kudo, Trans. Nat. Hist. Soc. Sapporo 5: 67. 1914; Flora Hokkaido and Saghalien II: 200, tab. 4. 1931.

Asia: Ob district (Sommier); Kamtchatka, Bolshaja river (Hultén); Sakhalin (GH!); Korea (Komarov 221, P!); Manchuria (Chaffanjon 1402, P!); Zeya-Bureya (Maximowicz); Udsk (Maximowicz); Primorsk region (NY!); Ussuri (US!).

North America: Aleutian Islands, Unimak, Amchtika, Attu, Unalaska, Atka (BM!, S!); coastal Alaska. — Ungava: rivière Korok, à environ 6 m de la baie Korok, 58° 35′ L.N. et 64° 15′ L.W. Rousseau 1146 (MTJB!). — Fig. 7.

Eriophorum Chamissonis C. A. Meyer, ex Ledebour, Fl. Altaica I: 70. 1829, in minima parte, tantum quoad plantam a Chamisso missam ex Unalaska; C. A. Meyer, Mém. Savants Etrang. Acad. St Pétersbourg I: 204. Tab. III. 1831, excl. pl. altaica; Juzepczuk, ex Komarov, Fl. USSR, III: 36. Tab. II, fig. 10 a–c. 1935, quoad plantam Asiae borealis extremae. — *E. dubium* Chamisso in sched., non Hegetschw., Fl. Schw. 52. 1840, non Steud., Cyp. Syn. Pl. Cyper. 128. 1855. — *E. intermedium* Cham. in litt. ad Meyerem, non Bastard, in Desv., Journ. Bot. 3: 19. 1814. — *E. Scheuchzeri* var. *Chamissonis* Nylander, Acta Soc. Sc. Fenn. 3: 8. 1852. — *E. medium* Hultén, Fl. Kamtchatka, I: 161. 1927; Fl. Aleut. 102. 1937; Fl. Alaska and Yuk. II: 281. 1942, tantum quoad plantas camtchaticas, aleuticas et alaskenses. — *E. Chamissonis* var. *aquatile* Fernald, Rhodora 27: 207. 1925; Gray's Manual, 8th ed. 277. 1950.

Asia: Tchukch Peninsula; Pitlekaj. St Lawrence Bay; St Lawrence Island; Kamtchatka.

North America: Aleutian Islands (numerous specimens from nearly all the islands, S!, MTJB!); Alaska; British Columbia and Vancouver Island (Macoun); Alberta (Raup, Malte, Turner); Saskatchewan (Raup); Manitoba; Ontario: James Bay area and inland in bogs at Mer Bleue and Alfred (Fletcher; Calder & Cody); Quebec (James Bay area); northern Newfoundland. — U.S.: Washington; Oregon; Montana; Idaho; Wyoming; Colorado; Utah; Minnesota. — Fig. 8.

f. ***Turneri*** Raymond, n. f. — Setis albidis. — Canada. Alberta: Open wet marsh $^1/_2$ mile SE. of Mama-O Beach. July 9, 1953. G. H. Turner (Type in MTJB). — Occurs throughout the range but has no area of its own. Specimens examined from the Aleutian Islands, Alaska, Alberta, Minnesota and Quebec (James Bay).

Hybrid.

×***E. medium*** Anderss., Bot. Not.: 62. 1857, quoad plantam europaeam solam, stat. nov. (*E. russeolum* × *E. Scheuchzeri*). — *E. russeolum* var. *aquatile* Norman, Archiv. Weath. Naturv. 5: 509. 1881. — *E. aquatile* Norman, Christ. Vidensk.-Selsk. Forh. no. 16: 43. 1893. — *E. Chamissonis* ssp. *aquatile* Lindman, Svensk Fanerogamfl. 113. 1918, non *E. Chamissonis* var. *aquatile* Fernald, loc. cit. — *E. Scheuchzeri* f. *medium* Neum., Sv. Fl. 679. 1901. — *E. intercedens* Lindb. fil., Sched. Pl. Finl. Exs. I–VIII: 32. 1906. — Setis pallide rufescentibus.

f. ***rufescens*** (Andersson) Blomgren, in Holmberg, Skand. Fl. 2: 295. 1926. — *E. rufescens* Andersson, Bot. Not.: 79. 1857. — *E. intercedens* var. *rufescens* Lindb. fil., Sched. Pl. Finl. Exs. I–VIII: 32. 1906. — Setis rufescentibus.

f. ***candidum*** (Norman) Blomgren, in Holmberg, Skand. Fl. 2: 295. 1926. — *E. russeolum* var. *candidum* Norman, Trondhj. Vid. S. Skr.: 46. 1865. — Setis albidis.

This hybrid ranges from northern Norway across northern Sweden and northern Finland to northern Russia and arctic islands (Novaya Zemlya) and, theoretically, eastward to the mouth of Ob river. — For detailed distribution in Scandinavia, see Hultén's Atlas (map 285), where the hybrid status of the plant is also suggested.

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Svensk Botanisk Tidskrift. Bd 48, H. 1. 1954.

TWO NEW SPECIES OF CUPHEA FROM BOLIVIA.

BY

ALICIA LOURTEIG.

Cuphea mapiriensis Lourt., n. sp.

Herbacea, ad 35 cm alta, canoso-pubescens et setoso-glandulosa. Radices ramosae, fibrosae. Caules ad basin lignosi (ad 4 mm lati), in parte superiori tomento brevi, albo et setis glandulosis flavidis vestiti. Internodi 0.5—1 cm longi, quam folia valde breviores. Folia decussata, lanceolata aut linearia (15—35 × 1.5 —4 mm), in petiolis pubescentibus (1—2 mm) attenuata, acuta, 1-nervosa (nervo in utraque pagina conspicuo, rufescenti), tomento adpresso, albido, utraque facie aeque evoluto, setis flavidis sparsis, in pagina superiori numerosioribus; margine plus minusve cartilagineo, deorsum anguste replicato, plus minusve ciliato. Flores alternati, pedunculis infrapetiolaribus, tenuibus, tomentosis (6—7 mm), apicem versus duobus bracteolis munitis; bracteolae (circ. $^2/_3$ mm) ovato-lanceolatae, tomentosae. Calix (5 –6 mm) angustus, in fauce paullo dilatatus, calcari vix conspicuo, obtuso, lobulis dorsalibus majoribus, appendicibus intersepalicis brevibus, setosis, tomento subtili, albido, setis glandulosis et flavescentibus intersperso; intus glaber at in parte superiori a tergo staminum dense pubescens. Petala 6, violacea, obovato-cuneata (circ. 2.5 × $^2/_3$ mm), dorsalia majora (circ. 3 × 1.5 mm). Stamina 11, marginem calicis non aequantia, duobus dorsalibus brevissimis, tribus episepalicis ventralibus glabris, caeteris pubescentibus. Discus subcylindricus, curvato-erectus. Ovarium subovoideum, glabrum. Stylus tenuis, glaber. Stigma parvum, capitatum. Ovula 8—10. Semina fuscescentia, suborbicularia aut subellipsoidea, complanata (circ. 1.5 mm), foveolata.

Typus. — Bolivia, Mapiri, alt. 5000 ft., leg. H. H. Rusby (1924), May 1886 (NY).

Similar in its habit to *C. Spruceana* from which it differs in the disk and in the pubescence, especially that of the calyx. It belongs to the Section *Brachyandra*, Subsection *Melanium*, Series 1 and its nearest neighbour would be *C. calophylla*, from which it differs in the aspect of its leaves.

Named for the type locality.

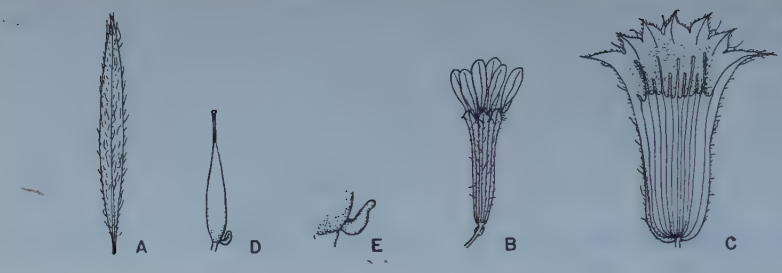

Fig. 1. *Cuphea mapiriensis* Lourt. — *A*, leaf, ×2; *B*, flower, ×2.5; *C*, calyx opened, ×5; *D*, pistil with the disk, ×5; *E*, disk, ×20. All from the type Rusby 1924 (NY).

Cuphea Rusbyi Lourt., n. sp.

Herbacea, ad 40 cm alta, ad basin sublignosa, pubescens et setosa. Radices fibrosae. Rhizoma tenue, sublignosum. Caulis erectus aut decumbens, ramosus, striatus; rami duabus lineis pilorum subtilium, albidorum et setarum glandulosarum sparsarum (1 mm), flavescentium aut purpurascentium muniti. Internodi longi (ad 4 cm), longitudinem folia plus minusve aequantes. Folia decussata, sessilia, anguste linearia aut lanceolata (10—40 × 1.5—4 mm), acuta, nervo centrali conspicuo, pilis cystolithicis vix visibilibus, setis paucis sparsis in utraque pagina et in nervo superficiei inferioris; margine adpresso-ciliato, deorsum plus minusve replicato. Flores alternati, infrapetiolares, pedunculis brevibus apicem versus duobus bracteis munitis ($^2/_3$—1 mm); bracteolae ovatae, ciliatae. Calix purpureus (5—7 mm), tenuis, apicem versus angustatus (in fructu ampullaceus), fauce paullo dilatata, margine ciliatus, caetera glaber et setis purpureis sparsis munitus; calcar incurvatum; appendices intersepalicae minutae; intus in parte superiori a tergo staminum lanato-pubescens, caetera glaber. Petala purpurea, parva, oblongo- aut ellipsoideo-spathulata (circ. $3 \times {}^3/_4$ mm), obtusa aut acuta. Stamina 11, inclusa, filamentis tenuibus, episepalicis majoribus, duobus dorsalibus pubescentibus, epipetalicis glabris. Discus carnosus, crassus, subhorizontalis, in parte superiori lobulatus. Ovarium ovoideo-asymmetricum (circ. 3.5 mm), in stylum glabrum, brevem (circ. 1 mm) attenuatum. Stigma capitatum, papillosum. Ovula 5–6. Semina fuscescentia, complanata, suborbicularia (circ. 2.5 mm) subtilissime foveolata, ala angusta circumdata.

Typus. — Bolivia, dep. La Paz, Rurrenabaque, alt. 1000 ft., leg. H. H. Rusby (117 a), 1921 (NY). Isotypus in US.

Also belongs to this species: Cochabamba, cataracts of the Bopi river, alt. 3000 ft., leg. H. H. Rusby (480 A), September 1921 (NY).

This species belongs to the Section *Brachyandra*, Subsection *Balsamonella* and it is much related to *C. carthagenensis* (= *C. Balsamona*) from which it differs in its leaves, habit and its calyx when in fruit.

Cuphea Rusbyi LOURT., n. sp. — Type specimen.

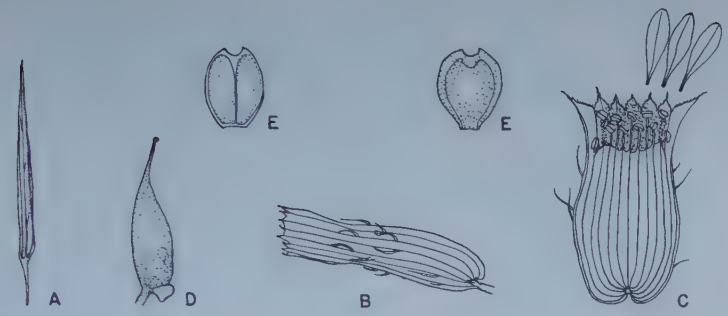

Fig. 2. *Cuphea Rusbyi* Lourt. — *A*, leaf, ×1; *B*, calyx, ×4; *C*, the same opened with petals, ×4; *D*, pistil with the disk, ×4; *E*, seed, dorsal view, ×4; *E'*, the same, ventral view, ×4. All from the type Rusby 117a (NY).

Dedicated to Dr. Henry Hurd Rusby (1855—1940), American collector who botanized in Bolivia and collected the type specimen.

The photograph of the type specimen of *Cuphea Rusbyi* has been made by the courtesy of Dr. Reed C. Rollins to whom my acknowledgement is herein expressed.

Gray Herbarium of Harvard University, Cambridge, Mass., November 1953.

Svensk Botanisk Tidskrift. Bd 48, H. 1. 1954.

GROWTH FACTOR REQUIREMENTS OF MYCORRHIZAL FUNGI OF FOREST TREES.[1]

BY

ELIAS MELIN.

It is a remarkable feature of the mycorrhizal relations in forest trees that many different fungal species are mycorrhiza-formers with the same tree species (Melin 1953). For a deeper understanding of these relations it is therefore necessary to study thoroughly different fungal associates from physiological points of view. Particularly, it may be of great interest to compare different mycorrhizal fungi of the same host; it may be assumed that they have one or more physiological properties in common.

It has repeatedly been shown in this laboratory that different tree mycorrhizal fungi behave differently in pure culture. Some grow easily in nutrient solutions whereas others develop very slowly. Several fungal species which were assumed to produce tree mycorrhizae, could not be made to grow at all in pure culture. It therefore seemed important to investigate the tree mycorrhizal fungi with regard to their requirements for vitamins and other metabolites.

The mycorrhiza-forming Hymenomycetes and Gasteromycetes studied are deficient for one or more B-vitamins when cultured in synthetic nutrient solutions, just as are many purely saprophytic soil Basidiomycetes (Norkrans 1950, Melin 1953). However, different species and even different fungal associates of the same tree have different demands in this respect. All species tested have been proved to be deficient for thiamine when cultured in synthetic nutrient solutions in pure culture. Most of them are only partially deficient for this vitamin but a few may be totally, or nearly totally, deficient.

[1] Presented at the International Congress of Microbiology held in Rome 1953.

Table I. Growth-promoting effect on various pine mycorrhizal fungi of thiamine and thiamine moieties on a molar basis (MELIN and NORKRANS 1942; MELIN and NYMAN 1941; NORKRANS 1950). Relative values.

	Control	Thiazole + pyrimidine	Thiazole	Pyrimidine	Thiamine
Amanita pantherina (DC. ex FR.)	2	10	2	3	11
Boletus granulatus (L.) FR.	0.3	10	0.3	1	10
„ *luteus* (L.) FR.	1	10	5	2	8
„ *variegatus* (SW.) FR. ...	0.1	10	0.1	0.2	10
Paxillus Prunulus (SCOP. ex FR.)	0.2	10	0.4	0.2	10
Cortinarius glaucopus (SCHAEFF. ex. FR.) FR.	0.1	0.1	0.1	0.1	10
Tricholoma albobrunneum (PERS. ex FR.).....	5	10	5	8	12
Tricholoma fumosum FR.	2	10	1	1	5
„ *imbricatum* FR.	2	10	2	5	8
„ *pessundatum* FR. ...	2	10	2	10	10
„ *vaccinum* (PERS. ex FR.).....	1	10	2	5	8

Most species are heterotrophic for both thiamine components (Table I), while some (e.g. several *Tricholoma* species) are more deficient for pyrimidine than for thiazole. Some *Cortinarius* species tested showed a reduced capacity of synthesizing thiamine from its two components (MELIN, unpublished).

Besides thiamine, some tree mycorrhizal fungi have one or more additional vitamin requirements. By way of example, among Hymenomycetes forming mycorrhizae with pine, *Tricholoma imbricatum* is partially heterotrophic for panthotenic acid (NORKRANS 1950), and *T. fumosum* and *Lactarius deliciosus* partially deficient for nicotinic acid (NORKRANS 1950, MELIN 1953).

Most tree mycorrhizal Basidiomycetes investigated were highly favoured by small amounts of amino acids in nutrient media containing ammonium nitrogen. These fungal associates behave in this respect as many saprophytic soil fungi. The beneficial effect may be due to an inability of the fungi to synthesize some indispensable amino acids utilizing ammonium nitrogen as rapidly as needed for optimum growth. However, different tree mycorrhizal fungi have different demands for amino acids (NORKRANS 1950, 1953; MELIN 1953, 1954).

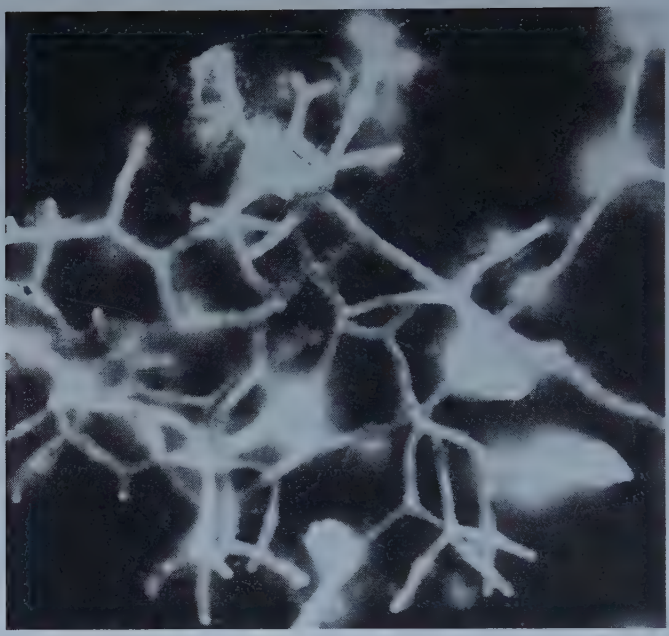

Fig. 1. Development of *Boletus bovinus* (L.) Fr. around an aseptically grown pine root in a nutrient solution containing glucose, salts, vitamins and amino acids. Incubation time 4 days. — 6 : 1.

Fig. 2. Development of *Boletus luteus* (L.) Fr. around an aseptically grown pine root in a nutrient solution containing glucose, salts, vitamins and amino acids. Incubation time 4 days. — 6 : 1.

Table II. Growth-promoting effect of excised pine roots on various mycorrhizal Basidiomycetes. Relative values.

Fungus	Incubation time in days	Thiamine		Amino acids and B-vitamins	
		without root	with root	without root	with root
Boletus bovinus (L.) Fr.	13	—	—	42	100
„ *edulis* Bull. ex Fr.	14	—	—	26	100
„ *elegans* Fr.	14	—	—	34	100
„ *subtomentosus* L. ex Fr.	11	41	60	66	100
„ *variegatus* (Sw.) Fr.	10	14	64	20	100
Amanita muscaria (L.) Fr.	22	31	56	44	100
„ *pantherina* (DC. ex Fr.)	21	—	—	27	100
Cortinarius glaucopus (Schaeff. ex Fr.) Fr.	21	—	—	7	100
Pholiota caperata Pers. ex Fr.	22	—	—	6	100
Rhizopogon roseolus (Corda) Th. Fr.	10	8	55	16	100
Russula xerampelina Schaeff. ex Fr.	38	0.2	100	1	100

The different requirements of different tree mycorrhizal fungi for B-vitamins and amino acids indicate that, in nature, the main sources of these metabolites for those fungi may not be the root but the soil. Deficiences of tree mycorrhizal fungi for B-vitamins or amino acids may therefore be excluded as factors leading to their association with roots.

The effects of root-metabolites on tree mycorrhizal fungi have recently been studied in this institute by using cultures of excised pine (*Pinus silvestris*) roots. For this purpose aseptic pine roots were grown in a suitable nutrient solution (Slankis 1951) in Erlenmeyer flasks for about five months. Their dry weight was then about 10–15 mg. The nutrient solution of the root cultures was substituted by media previously used in our studies on the requirements of the fungi concerned for vitamins and amino acids. The basic solution was supplemented with thiamine, or with a mixture of B-vitamins as well as a mixture of amino acids in the same proportions as in a casein hydrolysate. The flasks were inoculated with hyphal suspensions of various fungi known or presumed to produce mycorrhizae with conifers.

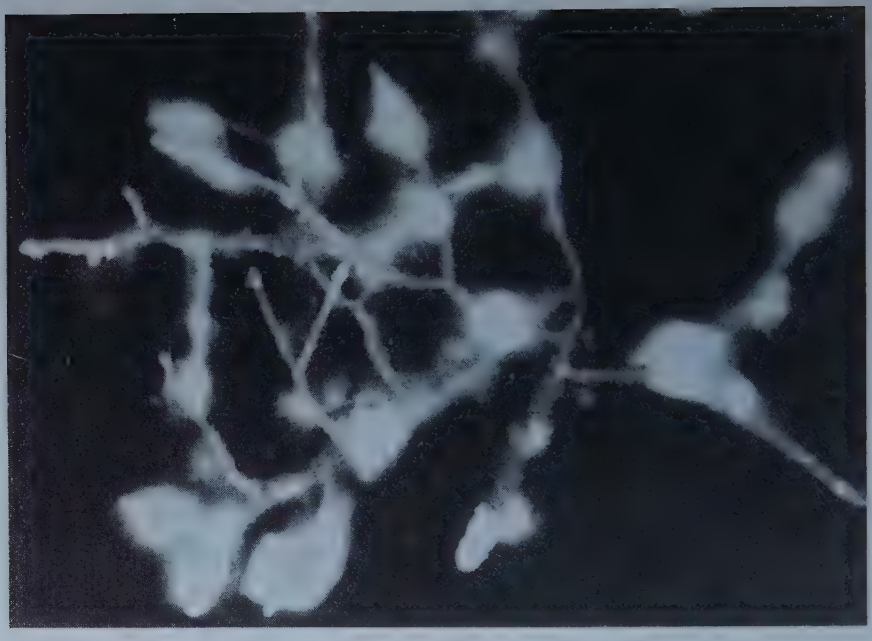

Fig. 3. Development of *Russula xerampelina* Schaeff. ex Fr. around an aseptically grown pine root in a nutrient solution containing glucose, salts, vitamins and amino acids. Incubation time 20 days. — 3.5 : 1.

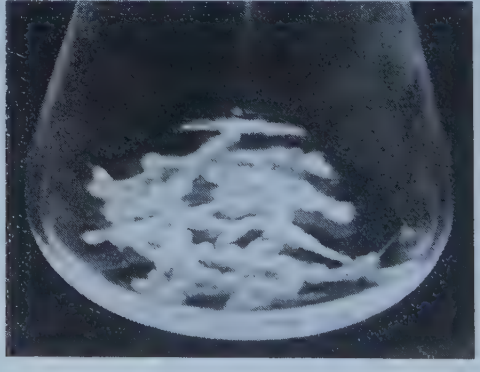

Fig. 4. Growth of *Russula xerampelina* Schaeff. ex Fr. around an aseptically grown pine root in a nutrient solution containing glucose, salts, vitamins and amino acids. Incubation time 5 weeks. — 5 : 7.

In the case of rapidly growing species, a heavy development of mycelia could be observed around the roots already after a couple of days. Fig. 1 illustrates this root effect on a pine mycorrhizal fungus, *Boletus bovinus*, after 4 days of incubation, and Fig. 2 shows the same effect on another pine mycorrhizal fungus, *B. luteus*, also after 4 days.

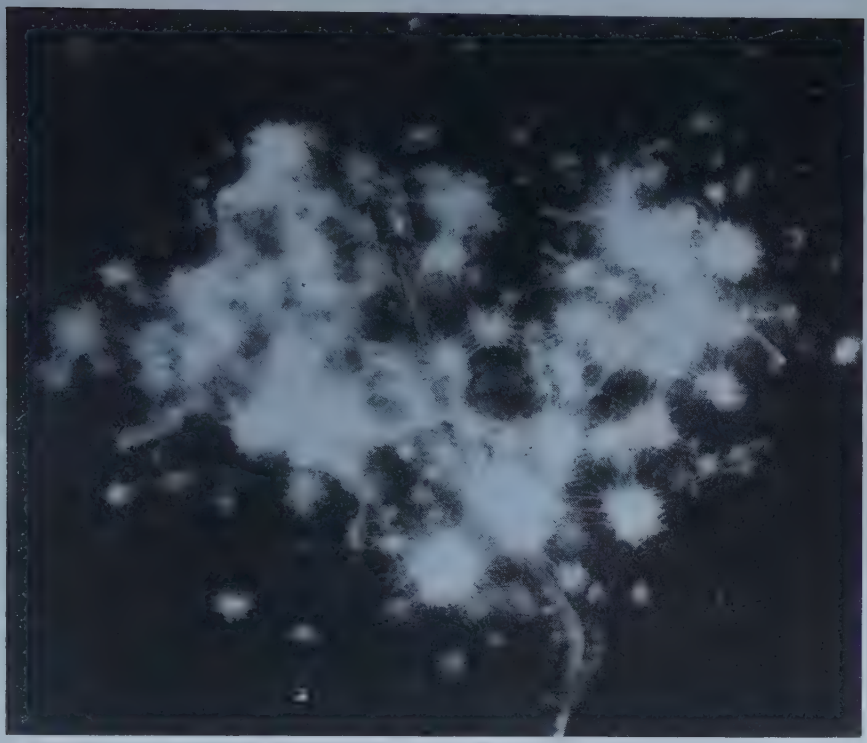

Fig. 5. Effect of an aseptically grown pine root on the growth of *Boletus variegatus* (Sw.) Fr. in a plate on nutrient agar. For explanation see text. — 2.5 : 1.

Table III. Growth-promiting effect of excised tomato roots on various mycorrhizal Basidiomycetes. Basic solution supplemented with amino acids and B-vitamins. Relative values.

Fungus	Incubation time in days	Without root	With root
Boletus edulis Bull. ex Fr.	14	22	100
„ *elegans* Fr.	10	11	100
„ *variegatus* (Sw.) Fr.	10	19	100
Pholiota caperata Pers. ex Fr.	22	0.5	100
Russula xerampelina Schaeff. ex Fr.	38	0.5	100

In the control flasks the growing mycelia were scarcely visible to the naked eye. The growth-promoting root effect was most conspicuous in the case of those species which had previously developed very poorly, e.g. *Russula xerampelina*. Fig. 3 shows the development of the mycelia of this fungus around the roots after 20 days and Fig. 4

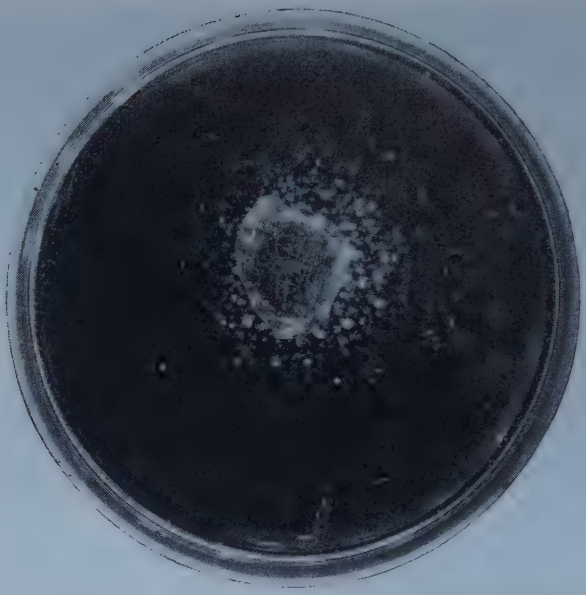

Fig. 6. Effect of an aseptically grown pine root on the development of *Boletus variegatus* (Sw.) Fr. on nutrient agar. For explanation see text. Incubation time 7 days. — 4 : 5.

that after 5 weeks. The mycelia had grown mainly around the roots. In the control flasks without roots, they were minute.

The magnitude of the growth-promoting root effect for some mycorrhizal fungi tested is illustrated by Table II. It is very different for different fungi.

The smallest effect was found in *Boletus* species, such as *B. subtomentosus* and *B. bovinus*, and in *Amanita muscaria*, the largest one in *Russula xerampelina*, *Pholiota caperata* and *Cortinarius glaucopus*. From the table it seems evident that the roots could not cover the demands of the fungi for B-vitamins and amino acids.

It can be concluded from these experiments that the pine roots produce one or more growth-promoting metabolites, which are essential to the growth of tree mycorrhizal fungi. It may be assumed that the fungi concerned are deficient for this root-produced substance, although the degree of this deficiency varies widely for various species.

In similar experiments the influence of excised tomato roots (about 14 days old) was studied. It was found that living tomato roots affected the growth of tree mycorrhizal fungi in the same way as pine roots, as is illustrated by Table III.

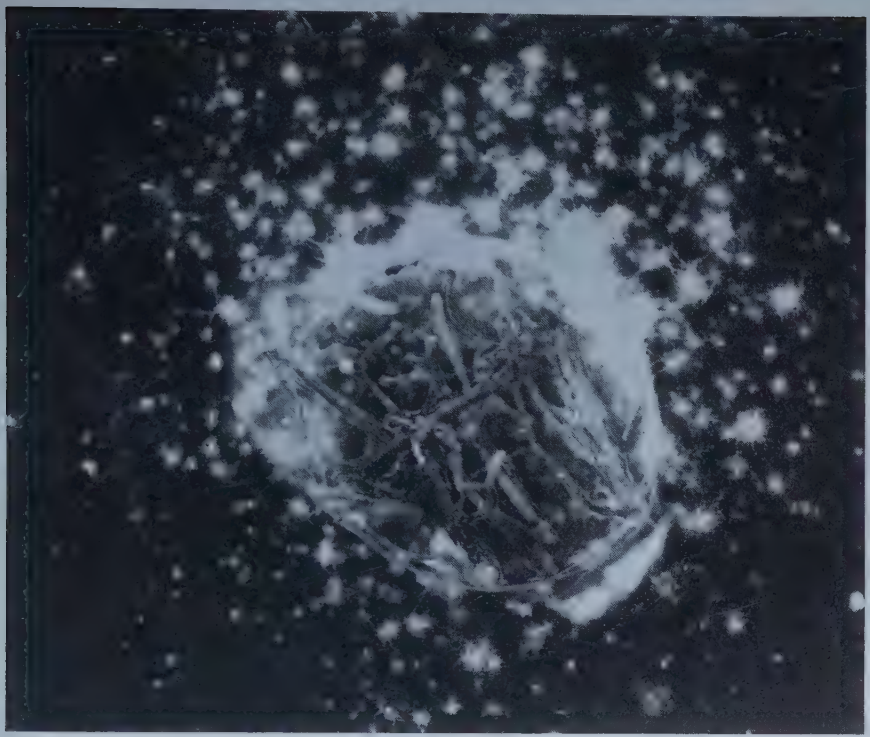

Fig. 7. Effect of an aseptically grown pine root on the growth of *Boletus variegatus* (Sw.) Fr. on nutrient agar. Cf. Fig. 6. — 2.5 : 1.

Also in this series of experiments the highest effect was attained in slowly growing species, such as *Russula xerampelina* and *Pholiota caperata*. It can be concluded that the metabolite concerned is not specific for pine roots but is produced also in roots of other plants. It was also found in germinating pine seeds.

The influence of root metabolites on the growth of tree mycorrhizal fungi was nicely demonstrated on nutrient agar plates by using the auxanographic method according to Beyerinck.[1] In these experiments *Boletus variegatus* was mainly used as test organism. The inoculation material was obtained from submerged mycelia grown for some days in nutrient solution under continuous shaking. The mycelia were thereafter thoroughly shaken in distilled water with glass pearls (Wikén *et al.* 1951), giving a dense hyphal suspension. This was passed through a very fine sieve, which made it as homogeneous as possible. For each agar plate 1–3 ml of this final suspen-

[1] The method used was developed in cooperation with Fil. lic. Eskil Wikberg.

sion were thoroughly mixed with the nutrient agar. The basic medium was supplemented with a mixture of B-vitamins and a mixture of amino acids, as mentioned above. Excised roots grown under aseptic conditions were transferred to the plates and placed directly or in celluloid sacks on the nutrient agar.

Fig. 5 illustrates the influence of a pine root on the growth of the hyphal inocula after 6 days of incubation at 25° C. A great number of large *Boletus* colonies had developed only around the roots, otherwise the colonies were small in the plates. Roots placed in celluloid sacks on the agar also caused a rapid development of the colonies around the sacks. Fig. 6 shows the effect of a sacked pine root after 7 days of incubation and Fig. 7 is a magnification of the same root with surrounding *Boletus* colonies. It is evident from this experiment that a growth-promoting metabolite had been exuded from the roots causing a stimulating rhizosphere effect.

The chemical nature of the growth-promoting metabolite is so far unknown. It may not be included among known B-vitamins, purine and pyrimidine bases and the amino acids in casein-hydrolysate.

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Institute of Physiological Botany, University of Uppsala, January 1954.

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CAREX HULTENII N. SP.

BY

ERIK ASPLUND.

In the winter 1931–32 H. Fröderström, M.D., and Lic. phil. (now Prof.) E. Hultén made a collection of plants in Mexico. The collection, comprising 1340 numbers, was received at the Botanical Department of the Swedish Natural History Museum towards the end of the summer of 1932. With the aid of several specialists the bulk of the collection was determined during the following winter, but several specimens remained unidentified. Among them there are surely some new species. One of them is described below.

Carex Hultenii Aspl. n. sp.

Subgenus *Indocarex*. Rhizoma crassum, lignosum, ut videtur breve (pars superior tantum nota). Culmus unicus notus erectus, sat robustus, 90 cm altus, triquetrus, angulis modice acutis faciebus concavis striatis, basi foliis marcidis vaginis non fibroso-dissolutis cinctus. Folia basalia culmum subaequantia, c. 15 mm lata, apice longe attenuata, chartaceo-coriacea, secus nervos leviter plicata, scaberula. Folia caulina 2, basalia similia, longe vaginantia, culmum aequantia vel paullo superantia. Inflorescentia depaniculata, 45 cm longa, supra continua, basi interrupta, sed etiam paniculae secundariae infimae internodiis longiores. Bracteae inferiores foliis similes, 5 infimae culmum superantes, superiores apicem versus decrescentes. Paniculae secundariae pyramidato-ovatae, ad nodum infimum et ad apicem singuli, ceterae ad nodos binae, supremae congestae non facile distinguendae. Pedunculi stricte erecti culmo subadpressi, infimus 9 cm longus, ceteri apicem versus abbreviati, paniculae supremae sessiles. Rhachis inflorescentiae parte superiore et raches paniculae secundariae trigonae, in angulis acutis ciliolato-scaberulae, rami ultimi etiam faciebus hispidulis. Spiculae numerosae, 4–7 mm longae, androgynae, sessiles, patentes vel patentissimae, parte mascula feminea breviora vel interdum subaequilonga. Bracteolae ovato-rotundatae usque rotundatae, castaneo-lineolatae vel punctatae, hispidulae, 1,5–2 mm longae, nervo medio in aristam ciliato-hispidulam ad 9 mm longam excurrente. Clado-

prophylla basi utriculiformia, straminea, apice glumiformia, castaneo-lineolata, hispidula vel glabrescentia. Glumae femineae statu fructifero patentes usque patentissimae, ovatae, cymbiformes, subobtusae vel acutiusculae, apice vel paullo sub apicem brevissime-0,5 (infima ad 0,75) mm longe mucronatae, multinerviae, dense castaneo-striolatae vel punctatae, inferiores praecipue nervo medio hispidulae, superiores plerumque glabrescentes. Glumae masculae femineis subsimiles sed angustiores, erectae, glabrae. Utriculi late ovati vel subglobosi, ± obliqui, turgidi, straminei, nitidi, rostro excluso 2–2,5 mm longi, 1,5–2 mm lati, apice marginibus versus pilis paucis brevissimis subaculeiformibus instructi, ceterum glaberrimi, praeter nervos marginales in parte superiore utriculi prominentes, ceterum ± impressos subenervi nervis brevibus obsoletis vel valde tenuibus praediti, basi non vel vix stipitiformiter gibbosi, apice subabrupte rostrati. Rostrum compressum, ± obliquum, anguste marginatum, minute spinuloso-serrulatum, c. 1 mm longum, apice bidentatum ore obliquo dentibus facie superiore (adaxiale) 0,3 mm longis, facie inferiore (abaxiale) brevissimis. Achenium trigonum, 1,75–2 mm longum, 1 mm latum, faciebus leviter concavis vel subplanis, apice basi incrassata styli mox caduci coronata. Stigmata 3.

In regni Mexicani civitate Puebla in regione Huachinango ad torrentem Salto Grande fluminis Necaxae 1000 m supra mare leg. H. Fröderström et E. Hultén 10 Febr. 1932, n. 757. Typus (specimen unicum) in Herb. S.

As stated above there is only one specimen at hand. It is overmature; very few utricles—except some undeveloped ones, the flowers of which have apparently not been fertilized—can be found in the spikelets, but several mature ones fallen off stick to the panicle. The upper bracts are broken except the uppermost more or less squamiform ones.

The cymbiform female glumes are mostly torn by the swelling ripening utricles and more or less split or frayed at the tip and the margins. In the central part of the inflorescense they are generally so ragged that their original shape can hardly be recognized. At the top of the inflorescense they are more intact, perhaps because the utricles have fallen off before being fully developed. Abortive utricles are more numerous in the uppermost part of the inflorescense than lower down.

The shape of the utricles is variable (Fig. 1 b–e). The minute aculeiform hairs are sometimes rather conspicuous (Fig. 1 b, c), sometimes lacking (Fig. 1 d, e). The marginal nerves are displaced owing to the unsymmetrical position of the achene. They are more or less prominent in the upper part of the utricle, in the lower part they are somewhat impressed or even running at the bottom of a groove.

Carex Hultenii Aspl. n. sp. — Photo M. Ferm.

Fig. 1. *a—g Carex Hultenii* Aspl., *a* spikelet, at the base bracteole and cladoprophyllum, above them one glume with abortive utricle, then 4 glumes, the utricles of which have fallen off, 3 glumes with abortive utricles and at the top male glumes, *b* adaxial and *c* abaxial face of same utricle, *d* and *e* marginal views of two utricles, *f*, *g* achenes, *h*, *i* utricles of *Carex cruciata* Wahlenb., *h* from type specimen in the Bergius herbarium, *i* from Parry 992 (Assam, Garo Hills), Herb. C. G. Alm. — *a* 8 ×, *b—e*, *h*, *i* 10 ×, *f*, *g* 12 ×. S. Ekblom delin.

In describing the utricles I have avoided the terms dorsal and ventral since they are ambiguous. In taxonomy of glumaceous plants the face turned towards the axis is generally called ventral, which seems reasonable e.g. as to the decidedly dorsiventral utricles of certain species of *Carex* Subgen. *Vignea* (Sections *Muehlenbergianae*, *Stenorhynchae* etc.) and as to the glumes and lemmas of most grasses. However, within other groups of flowering plants the terminology is reverse; nobody says that the flower of a *Lamium* or *Pedicularis* turns its ventral face towards the axis of the inflorescense.

In the *Carex* system of Kükenthal (Pflanzenreich IV: 20, 1909) the position of *Carex Hultenii* is within Sect. 38 *Indicae* Subsect. *Turgidulae*. However, it is very different from all known American species of this Subsection. It thus seems that its affinities must be sought among the Old World species. The fact that there seems to have been found only one individual might perhaps indicate that it has been occasionally introduced, but the statement of the collectors as to its habitat excludes this possibility or makes it at least very improbable. The eminent caricologist Dr. E. Nelmes of Kew, to whom

I have shown the specimen, informs me that it does not belong to any species known from the Old World and that he considers *Carex cruciata* Wahlenb. to be its most close relative among species known. *Carex Hultenii* differs from *C. cruciata* in having wider leaves, secondary panicles binate except the lowermost one and the congested uppermost ones, and more turgid, almost nerveless, utricles. In fact, the utricles are so different from those of *C. cruciata* that I doubt that *C. Hultenii* can be placed within the Section *Cruciatae* (C. B. Clarke) Nelmes, Reinwardtia I: 3 (1951), if the Section is taken in the restricted sense given to it by Dr. Nelmes. When more material is available it will perhaps be regarded as the Type species of a new Section of Subgen. *Indocarex*.

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NOTIS OM VARIATIONEN I STIFTENS ANTAL HOS STELLARIA LONGIPES GOLDIE OCH S. MONANTHA HULTÉN.

av

ERIK SÖDERBERG.

Stellaria-släktet, som omfattar mer än 100 arter, uppdelas av F. Pax och K. Hoffmann (1934) på sex sektioner. Hos arterna inom fyra sektioner är stiftens antal 2. *Adenomena*-sektionens arter ha 3 stift, under det att arterna inom sektionen *Eustellaria* ha 3, sällan 4—5 stift. Till sektionen *Eustellaria* höra *S. longipes* Goldie och *S. monantha* Hultén, vilka odlas i fjällpartierna i Hortus Botanicus Bergianus. Under flera år hade jag hos dessa båda arter, vilka tillhöra subsektionen *Larbreae*, iakttagit en variation i stiftens antal. På grund härav påbörjade jag år 1949 en statistisk undersökning av stiftens antal i blommorna. Som ett bidrag till dessa formers blommorfologi och systematiska rangställning redogör jag här för mina iakttagelser.

Stellaria longipes har i Hortus Bergianus dragits upp ur frön av i Canada vildväxande plantor. Fröna hade erhållits från Jardin Botanique de Montreal år 1940 under beteckningen *Stellaria longipes* Goldie var. *laeta* (Richards.) Wats., men plantorna, som växte upp, tillhörde *S. longipes* Goldie (s. str.). *S. monantha* Hultén härstammar från Västgrönland, varest den insamlats av komminister emer., fil. dr J. Lagerkranz år 1936. Arten medföljde tuvor av en del levande växtmaterial, som Lagerkranz hemförde från Ameralik och Godthaab för Bergianska trädgårdens räkning. Denna art trives utmärkt i denna trädgård, både i de systematiska kvarterens styva lera och på fjällpartiets lättare och väl dränerade jord.

Stellaria monantha blommar nära två veckor tidigare än *S. longipes*. År 1950 började den förra sin blomning den 18.5 och den senare

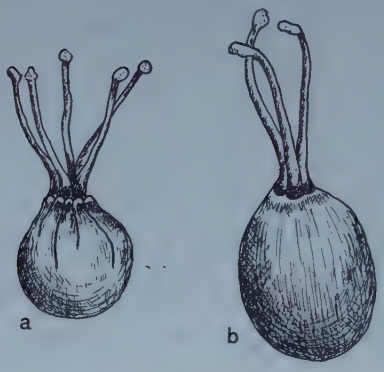

Fig. 1. a. *Stellaria longipes* Goldie. Fruktämne med 5 stift. ×5. — b. *S. monantha* Hultén. Fruktämne med 3 stift. ×5.

den 31.5. Båda arterna producera årligen rikligt med grobart frö. De numera döda exemplaren av *S. crassipes* Hultén, som erhållits från Lule lappmark, satte aldrig frö. De mogna kapslarna äro hos *S. monantha* 6,5—7,5 mm långa, smalt ovoida, utskjutande (calyx 4 mm lång), glänsande, med ljusbrun bas och mörkbrun topp samt hos *S. longipes* 4,5—5 mm långa, ovoida, utskjutande (calyx 4 mm lång), glänsande, med ljusbrun bas och svartaktig topp. Bägge arternas kastanjebruna frön äro svagt rynkade (rugulosa) och till storleken minst hos *S. longipes*. Hos *S. monantha* äro kronbladen 7 mm långa, kronbladsflikarna mäta 5 mm i längd, foderbladen 4 mm och 1,5 mm i bredd, och de 5 mm långa ståndarnas sträng är 4 mm lång och knappen 1 mm lång. Hos *S. longipes* äro de 5 mm långa kronbladen flikade till basen, foderbladen äro 4 mm långa och 1,5 mm breda och ståndarna 3,5 mm långa med 0,5 mm lång knapp.

Samma egendomliga övervintring, som Čelakovsky (1881) och Raunkiær (1907) påvisat hos *Stellaria holostea* L. och ett flertal *Cerastium*-arter, utmärker även *S. longipes* och *S. monantha*. Redan på hösten bildas i bladvecken på de till marken nedtryckta fjolårsstjälkarna gröna skottknoppar, vilka nästa vår växa ut till nya skott. Dessa skottknoppar stå i förbindelse med rotsystemet genom stammens levande gröna centralställda vävnader, vilka det döda barkparenkymet omger liksom en skyddande mantel. Övervintringsknopparna hos båda arterna voro 5—8 mm långa den 5.1. 1952. Vid groning av dessa skottknoppar utvecklades rötter i de tre nedersta bladparsvecken.

Tabell I. Stellaria longipes Goldie.

Antal blommor	Antal stift i varje blomma	Antal stift
9	6	54
71	5	355
136	4	544
33	3	99
249		1 052

Stiftens medeltal i varje blomma $= \frac{1\,052}{249} = 4$ (4,22).

Tabell II. Stellaria monantha Hultén.

Antal blommor	Antal stift i varje blomma	Antal stift
35	4	140
192	3	576
227		716

Stiftens medeltal i varje blomma $= \frac{716}{227} = 3$ (3,14).

Som framgår av tabell I varierar stiftens antal hos *Stellaria longipes* mellan 3 och 6, och medeltalet stift är 4. Tabell II visar att stiften hos *S. monantha* äro antingen 3 eller 4 och att medeltalet är 3. Då bägge arterna odlats under likartade förhållanden både vad jordslag och ljusintensitet beträffar, betingas olikheterna i antalet stift dem emellan ej av yttre faktorer. Genom en statistisk undersökning på vildväxande individ skulle klarhet kunna vinnas, om odlingen har någon inverkan på variationen i stiftens antal. Reinöhl (1903) har nämligen hos *Stellaria media* (L.) Cyr. påvisat ett samband mellan näringsförhållandena och blommornas organisation. Han fastställde genom räkning av ett stort antal blommor androeceets variationskurva, som visade sig vara 2-toppig med ett huvudmaximum på 3 och ett sekundärmaximum på 5. I kultur fingo en del individ växa i svagt ljus och undernärdes på så vis, medan andra odlades i fullt ljus och på väl gödslad jord. Vid ringa ljus-

intensitet erhölls en 1-toppig kurva med maximum på 3 och utan plusvarianter. I försöket med fullt ljus låg maximum på 5, och samtidigt erhölls ett stort antal plusvarianter med talet 8.

Enligt Reinöhl äro sålunda de utslagsgivande faktorerna för ståndarantalets variation exemplarens ålder, markbeskaffenheten och belysningens intensitet. Han skriver om dessa faktorer: »Sie bestimmen die Formeneinheiten, aus deren Variation im Einzelnen sich die Gesamtvariation der Species zusammensetzt. Die Variationsmittelpunkte bilden die Zahlen 3 und 5. Die Gesetzmässigkeit, die im Hervortreten dieser Zahlen zum Ausdruck kommt, kann nur in inneren Ursachen begründet sein. Beobachtung und Experiment zeigen den einheitlichen Ursprung der verschiedenen Gruppen. Ob diese das erste Resultat eines Umbildungsprocesses darstellen, der mit der Auflösung der Species in einzelne selbständige Arten endigt, lässt sich heute nicht entscheiden.»

Böcher (1951) har utförligt behandlat utbredningen och ekologien beträffande *Stellaria longipes* Goldie, *S. monantha* Hultén, *S. crassipes* Hultén, *S. ciliatosepala* Trautv., *S. Laxmannii* Fisch. och *S. laeta* Rich. på Grönland samt med ett stort antal nya lokaler kompletterat Hulténs framställning (1943). Böcher visar även, att inom *S. longipes* - gruppen finnas mikrospecies med tydligt olika edafiska fordringar. Om *S. longipes* anför han: »edaphically it seems to be rather indifferent, as it e.g. in Greenland occurs both on basalt and in gneissic regions». Om *S. monantha* skriver Böcher följande: »It was completely absent in the various steppe-like communities on dry basic or neutral soils. Its pH range seems to be between 4.8 and 7.0 with a preference for the acid soils about pH 5—6 ... the species is somewhat acidophilous.»

Böcher & Larsen (1950), vilka cytologiskt undersökt några av dessa former, ha konstaterat att typisk *S. longipes* från Canada har $2n = 52$ och typisk *S. monantha* från Søndre Strømfjord på Västgrönland har $2n = 104$. Böcher (1951) har sammanfattat sin uppfattning om dessa former inom den kollektiva arten *S. longipes* sålunda: »Hence we can safely operate with these units, leaving it to the future to decide whether they are species, subspecies, or varieties. At any rate they are geographically distinct gene-complexes.»

Bergianska Trädgården, Stockholm 50, i oktober 1953.

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FLORA OCH VEGETATION I ALLGUNNENOMRÅDET I ÖSTRA SMÅLAND.

AV

RIKARD STERNER.

Preliminärt meddelande.

Under senare år har författaren ägnat några veckor av sommaren åt en växtgeografisk undersökning av ett område i östra Småland, som kan benämnas Allgunnenområdet. Allgunnen är en insjö av en för denna sjöfattiga trakt betydande storlek, nående nära en mil i längd och en största bredd av 4,5 km. Den är belägen i södra Kalmar län, på höjden av Mönsterås och knappt 3 mil innanför Kalmarsund. Undersökningsområdet omfattar för närvarande en sektion på ungefär 3 mils bredd och 6 à 7 mils längd från kusten in över länsgränsen till gränsen mellan socknarna Älghult och Lenhovda i väster. Det innesluter helt eller en större del av följande socknar: kustsocknarna Mönsterås, Ålem och Ryssby, därinnanför skogsbygdens socknar Fliseryd, Långemåla, Bäckebo och Kråksmåla (den senare liggande väster om Långemåla) samt inom Kronobergs län den väldiga socknen Älghult, som med sina 380 km² torde vara den näst största inom Götaland. Ännu återstå åtskilliga månaders fältarbeten, innan det uppställda programmet har genomförts. Nöjaktigt genomforskade äro för närvarande, frånsett själva kusten, endast Bäckebo, Långemåla och Älghult. Det måste alltså dröja åtskilliga år, innan den avsedda skildringen av områdets växtgeografi kan framläggas. Då emellertid de växtgeografiska uppgifter härifrån, som nu stå till forskningens förfogande, äro synnerligen knapphändiga och delvis missvisande, har författaren ansett det lämpligt att lämna en kort redogörelse för viktigare preliminära resultat.

Av flera anledningar utgör det nämnda området ett lockande ar-

betsfält. Förutom att det ligger i en trakt, som nästan kan betecknas som en vit fläck på den växtgeografiska kartan, är det ett övergångsområde, där såväl olika floraelement som olika vegetationstyper mötas. Kustlandet med sina ganska betydande marker av lerhaltiga marina sediment utgör ett klimatiskt såväl som trofiskt gynnat område, medan områdets inre del når in på den kargare småländska högplatån. Framträdande är även en annan motsättning. Till större delen hör området till den sydöstsmåländska slätten, där den starkt avplanade berggrunden sällan och endast med låga, avrundade berghällar höjer sig upp genom jordtäcket, och där isälvarnas mäktiga grusåsar äro så gott som det enda reliefgivande elementet i landskapet. Men i områdets nordvästra del, i Kråksmåla och i delar av Älghult, möta vi utlöpare av den starkt brutna terräng, som karaktäriserar sydöstra delen av Jönköpings län. Här går klippgrunden tätt i dagen, stundom i form av tvära bergknallar med klippbranter och sluttor av näringsrikt vittringsgrus och med källdrag eller småbäckar i dälderna.

I öst–västlig riktning växlar terrängen karaktär även i annat avseende. I själva kustlandet med en bredd av 5–10 km utmärkes terrängen av låga moränkullar utströdda på eller omslingrade av bördiga lermarker. Bebyggelsen är här tät, och jordbruksdriften sedan länge intensiv. Innanför, alltjämt på låga nivåer och under marina gränsen, är moränen allenarådande, inom stora områden blockrik och på grund av den flacka topografin ofta utbildad som grunda sumpmarker. Detta omkring två mil breda bälte kan karakteriseras som Storskogen. Odling och bebyggelse förekomma där mycket sparsamt, i huvudsak samlade utmed åsarna, och vida mader utmed de starkt slingrande vattendragen utgöra där de mest framträdande avbrotten i skogstäcket.

Allgunnen omslutes av denna Storskog. Sjön är som omgivningarna ange en grund, näringsfattig slättlandssjö med stränder av låga klippor eller blockrik morän. I grannskapet finnas flera mindre sjöar av liknande skapnad. Liksom Allgunnen äro de anslutna till eller genomflutna av Alsterån eller dennas tillflöden.

Storskogens vegetation är i stort sett torftig. På torra marken dominerar ljung- och lingonrik tallskog starkt, på fuktigare blåbärsrik blandskog. Smärre blötmarker intas ibland av skvattrammossar, ibland av skogs-fattigkärr med ymnig *Calamagrostis lanceolata*, *Carex filiformis* och *C. rostrata*, medan madängarna domineras av *Juncus filiformis*- och *Carex filiformis*-bestånd med porsöar och kan-

tas av *Molinia*-ängar och porssnår. Men inslag av ek, i anmärkningsvärt hög grad former av *Quercus petraea* × *Robur*, och även bok äro på sina håll framträdande, och här och där uppträda vegetationstyper, som vittna om en hög markbonitet. Kraftigare moränkullar kunna på sina sluttningar uppvisa vackert utbildad örtrik *Calamagrostis arundinacea*-blandskog med t. ex. *Ribes alpinum, Carex digitata, Vicia cassubica, Lathyrus niger* och *Laserpitium latifolium*, ja, stundom med lundarter såsom *Lathyrus vernus, Pulmonaria officinalis* och *Viola mirabilis*. Verklig lundvegetation kan påträffas på fuktigare mark, främst vid vattendragen, där den torde betingas av svämsandens och det rörliga vattnets gynnsamma inverkan på marken. Viktiga lundelement äro ask och alm, hassel, hagtorn, try och murgröna, *Brachypodium silvaticum, Milium effusum* och *Melica uniflora*, samt de nyssnämnda lundörterna jämte *Galium triandrum, Sanicula europaea* och *Cardamine bulbifera*. I mindre utsträckning kunna även kärrmarkerna visa högre näringsstandard. Vegetationen kan t. ex. utgöras av *Carex vesicaria*-bestånd med tuvor av *C. elongata* eller i enstaka fall till och med av *Carex riparia*- eller *C. remota*-bestånd.

Storskogen ligger givetvis under rationell drift. Till större delen utgörs den av Hornsö och Ebbegärde kronoparker. Talrika vägar ha anlagts, och sumpmarkerna äro i stor utsträckning dikade. Detta har emellertid skett först på de senaste decennierna; Hornsö-skogen blev kronopark för blott omkring 30 år sedan. Förmodligen främst på grund av de besvärliga transportförhållandena hade skogen länge legat i hög grad som vildmark. Av stort intresse är att i fråga om markvegetationen har den alltjämt kvar tydliga drag av en sådan. Man får alltså härigenom goda möjligheter göra jämförelser mellan vegetationen på motsvarande marker inom skogen och i de starkare påverkade områdena utanför densamma.

Kråksmåla och i än högre grad Älghult visar i flera avseenden en egen växtgeografisk karaktär. Visst dominera även här magra, blockrika moränmarker, och visst äro även dessa socknar i främsta rummet ett barrskogsland. Men barrskogstäcket brytes i livligare tempo, än av insjöar, än av bättre utbildade myrar, bland vilka vi först här kunna urskilja verkliga högmossar, än av mindre glest spridda odlingsbygder, som genom sina björkhagar och hävdade lövängar visar ett nytt ansikte. Till denna egenart bidrar icke blott den förut omnämnda livligare topografin. Vi befinna oss nu ovan marina gränsen, och detta torde vara orsaken till att ytmoränen oftare är

rik på finjord, vilket i stor utsträckning är odlingens och den rikare lövskogens naturliga betingelse.

När man från Bäckebo passerar länsgränsen och kommer in i Älghult, äro förändringarna i flora och vegetation ganska påtagliga och plötsliga. Av de snår av slån, björnbär och nypon, som följt landsvägarna upp från kustlandet, ser man föga eller intet. På ungefär samma sätt förhåller det sig med örtfloran på grusbackar och vägslänter. Av nya inslag, som möter ögat, är i främsta rummet att nämna de »naturliga» ängsmarkerna, ibland alltjämt omsorgsfullt hävdade genom slåtter och röjning, oftare lämnade åt sitt öde men ännu ej helt tagna i unggranarnas våld. Ängarna äro frappanta i sin miljö genom sin blomrikedom och ha i *Arnica montana* och *Leontodon hispidus* sina mest framträdande karaktärsväxter. Ängstypen kan betecknas som örtrik *Nardus*-äng, något ganska annorlunda än kustlandets *Nardus*-äng på fuktiga, magra marker. Av den örtrika ängens övriga viktigare arter kunna nämnas *Gentianella campestris*, *Centaurea jacea*, *Scorzonera humilis*, *Hypochaeris maculata*, *Helianthemum nummularium*, *Gymnadenia conopsea*, *Polygala vulgare* och *Melampyrum pratense* samt *Agrostis tenuis* och *Sieglingia decumbens*. Orsaker till dessa motsättningar stå att finna i kulturhistoriska förhållanden. Först på senare år har genom vägbyggen länsgränsen upphört att vara en skiljemur mellan bygder tillhörande i viss mån olika kulturområden. Men, som ovan nämnts, man kan även peka på orsaker av naturgeografisk art.

Givetvis är det icke länge sedan man även i den till Kalmar län hörande skogsbygden hävdade de »naturliga» ängarna. Tydliga spår härav äro icke sällsynta. På moränkullar i åkrarna, vid övergivna odlingar i skogen osv. kan man alltjämt träffa på *Arnica* och *Leontodon hispidus*, men de bli allt sällsyntare österut och saknas i kustlandet. Ett studium av vad uppgivandet av den gamla ängskulturen betytt för såväl landskapets utseende i stort som för dess floristiska detaljer ingår i författarens arbetsprogram.

Ett för Älghults växtgeografiska karaktär betydelsefullt terrängavsnitt återstår att framhålla. I sin södra del genomtvärs socknen av Alsteråns huvudgren. Denna rinner fram genom en skarpt markerad, trång dalgång, vars branta sidor äro höljda av morän eller isälvsavlagringar De mot söder vettande branta sluttningarna eller åbrinkarna uppvisa flerstädes en efter traktens förhållanden rik flora. En del av kustlandets kräsna arter ha här funnit sig tillrätta, men även den för det höglänta Småland karakteristiska floran har här

en av sina yttersta utposter mot slättlandet i sydost. De i den nedan följande lokalförteckningen ofta förekommande bynamnen Hoaskruv, Barkahult och Höneskruv gälla dylika platser.

Av föreliggande floristiska resultat lämnas nu ett urval. Principen härvid har varit att främst belysa de olika floraelementens utbredning i skogsbygden. För åtskilliga av de arter, som komma att nämnas, ha hittills helt få eller i något fall till och med inga växtplatser varit kända från sydöstra Småland. Av allt att döma torde detta icke få tydas så, att det område, som nu blivit något närmare undersökt, skulle vara så mycket rikare än andra. Det vittnar nog snarare om stora brister i kunskapen om hela denna landsändas flora.

I enstaka fall ha fullständiga förteckningar av nu föreliggande lokaluppgifter meddelats. Därvid ha även förut publicerade lokaler medtagits, hämtade ur Hård av Segerstad, Sydsvenska växtlokaler, I (Sv. Bot. Tidskr. 1927) och Sterner, Vegetation och flora i Kalmarsunds skärgård (Medd. fr. Göteborgs Bot. Trädg. VIII, 1933). Banktjänsteman Gustaf Nyström, Kalmar, har bidragit med uppgifter från Kråksmåla, och ur framlidne amanuensen Nils Blomgrens efterlämnade exkursionsanteckningar från 1924 ha ett antal anmärkningsvärda uppgifter kunnat erhållas.

Beträffande områdets naturgeografi kan hänvisas till förf:s uppsats i »Natur i Småland», »En ödemarkssjö och en storskog i sydöstra Småland».

Agrimonia odorata, som tidigare varit okänd i hela landskapet utom i Tjust, har befunnits i området ha ungefär samma frekvens som *A. Eupatoria*. Den är hittills antecknad från 25 lokaler, fördelade på 8 socknar från Ålem och Ryssby till Älghult.

Aira praecox är i kustlandet allmän men avtar hastigt inåt land; västligaste lokaler äro Kråksmåla: Isabo (Nyström); Högsby: Aboda klint; Långemåla: Stubbemåla; Bäckebo: Jonsryd och Kollingsmåla.

Allium Scorodoprasum tycks ha en tämligen jämn utbredning inom hela området; är alltid strängt bunden till gårdarnas nära grannskap utom vid kusten, där den går ut i den opåverkade yttersta skärgården.

A. vineale är tydligare kustbunden än *A. oleraceum* och tycks nätt och jämt gå in över länsgränsen (Älghult: Sjöamåla, åkerkant), medan den sistnämnda är anträffad flerst. ännu i Älghult.

Alopecurus aequalis är av Blomgren antecknad från ett par lokaler; Fliseryd: kyrkbyn; Högsby: Basthult vid L:a Sinnern; Kråksmåla: Kyrkbyn.

Anemone Pulsatilla följer Högsby- och Bäckebo-åsarna ett stycke inåt land; Fliseryd: Åselid; Långemåla: flerst. på Högsby-åsen; Bäckebo: Skillerhult och Luvehult.

A. ranunculoides har av ortsbor meddelats från åtskilliga platser i kustsocknarna, särskilt från Ålem. Sjöstrand, Calmar läns och Ölands flora (1863), uppger den från Kråksmåla och Bäckebo, och från den senare socknen föreligga även flera färska ortsbouppgifter: Luvehult, Skåningsmåla, nya prästgården, Knivingaryd och Millemåla.

Aphanes arvensis blir sällsyntare inåt land och är ej iakttagen i Älghult, dock ännu nära länsgränsen vid L:a Skedsbygd i Bäckebo och (enl. Nyström) Isabo och Kjösebo i Kråksmåla.

A. microcarpa. Långemåla: Bötterum Kroken; Bäckebo: mln Skillerhult o. Luvehult, L:a Skedsbygd; Kråksmåla: Flatehult (Nyström).

Arabis hirsuta förefaller vara strängt kustbunden. Västligaste fyndorter äro: Fliseryd: Ö om Kärnebo på åskullar; Ålem: Hundhult i *Calamagrostis arundinacea* - lundbacke på morän; Långemåla: Bötterum Kroken och N om kyrkan på åsbackar.

Armeria maritima v. *elongata.* Följande inlandslokaler, 2 à 3 mil från kusten, föreligga: Högsby: Kyrkbyn; Långemåla: S om Brusemåla; Bäckebo: Balebo; i samtliga fall sandiga åssluttningar.

Arnica montana. Östligaste lokaler: Fliseryd: Skorpetorp (kyrkoh. P. Ahlquist, 30 à 40 år gammal uppg.), Åselid; Långemåla: Stubbemåla, mln Böta och Böta göl vid övergiven odling i skogen; Åby: NO om Knarrebo vid p. 60,5 på gammal röjning i skogen, Orrenäs 1919, Sporsjö 1919; Bäckebo: Näversjö, mln Luvehult och Skillerhult; Kristvalla: Räggekulla och Slättingebygd. Allm. i Hälleberga, Älghult, Kråksmåla, Fagerhult och åtminstone västra delen av Högsby, flerst. i västra delen av Bäckebo.

Avena pratensis avtar hastigt i frekvens inåt. Långemåla: S om Brusemåla och Värlenäs på åsbackar; Kråksmåla: Kjösebo och Uvahult (Nyström); Älghult: Höneskruv. Bäckebo: 0.

Betula nana är endast känd från Älghult: Ideboås (J. A. Z. Brundin enl. Hård), Svartshult.

Brachypodium pinnatum. Endast känd från Bäckebo: 1 km SO om Brånarna i *Calamagr. arund.* - skogsbacke på åssluttning; Älghult: Barkahult på isälvsgrusbacke vid ån; Lenhovda: S om Sävsjöström stn i *Calamagr. arund.* - backe på isälvsgrus 1920.

B. silvaticum. Frånsett den av förf. redan 1919 funna lokalen Långemåla: Alsterhus Strömsholmen och lokalen Älghult: Fröseke (Brundin enl. Hård), har denna art tidigare varit okänd i hela östra Småland S om Västervikstrakten. Den är nu funnen på 17 lokaler, fördelade på samtliga socknar, som tillhör undersökningsområdet, utom Ålem och Mönsterås. I »Storskogen» är den ett nästan konstant element i lundartad vegetation, särskilt invid vattendragen.

Bromus Benekeni. Följande lokaluppgifter föreligga: Ålem: Sandbäckshult (Blomgren); Högsby: Aboda (id.); Långemåla: Alsterhus Strömsholmen 1919, 1950; Kråksmåla: Branthult (Blomgren).

Butomus umbellatus är endast känd från områdets utkant, Fliseryd: Läggevi och Gåsgöl i ån.

Campanula Cervicaria är endast känd från Ålem: Hundhult i *Calamagr. arund.* - lundbacke; Älghult: Barkahult på åbrinken. Dessutom kan nämnas lokalen Åsheda: Stödsboda (Kjellmark enl. Hård).

Cardamine bulbifera. Jfr inledningen. Flerst. i Långemåla och Bäckebo samt i Ålems och Ryssby skogsbygd. Dessutom Kråksmåla: Branthult; Högsby: Hästenäs; Älghult: S om prästgården och Djuphult.

C. hirsuta är allm. i kustlandet men når föga in i skogsbygden. Bäckebo: Näversjö och Kollingsmåla på hällmark i hagar; Kråksmåla: Uvanäs ruderat.

Carex capillaris. Högsby: Aboda (Blomgren) är den enda och högst anmärkningsvärda uppgiften.

C. digitata kan betecknas som det allmännaste lundartade elementet, antecknad från ett dussintal lokaler i var och en av socknarna Långemåla, Bäckebo och Älghult.

C. dioica tycks vara mycket sällsynt i hela området, men blir något rikligare i Älghult, där den anträffats på 4 lokaler.

C. elongata är mycket sälls. i kustlandet, men finns flerstädes i skogsbygden; 4 à 5 lokaler föreligga från vardera av Långemåla, Bäckebo och Älghult.

C. Hostiana. Enda lokaler: Ryssby: Skäggenäs Venenäs och Rev (Sterner); Älghult: Höneskruv vid foten av en backsluttning på isälvsgrus.

C. limosa. Enda lokaler: Ryssby: Skäggenäs Ö om Korsgården (Sterner); Kråksmåla: Mjöshult 1920; Älghult: Store Göl; Madesjö: Abbegöl.

C. montana tycks i området knappast nå öster om länsgränsen, men är i södra delen av Älghult iakttagen på 5 lokaler, östligast vid Långaskruv och Hoaskruv.

C. Pairaei är lika vanlig i Älghult som vid kusten.

C. pauciflora är endast känd från Älghult: St. Blötskog, Barkahult och Flöxhultsgölen.

C. pseudocyperus. Enda lokal är Långemåla: den sänkta Hökesjön S om Alsterhus 1919 och 1949.

C. remota. Samtliga lokaler nämnas här. Ryssby: 1 km S om Ebbegärde, 2 km NV om Fanketorp vid Norrebäcken; Långemåla: mln Nyland och Alsterhus, SV om Getebro, NO om Bötterum; Älghult: Ideboås (Brundin enl. Hård), i bäckdalen Ö om byn.

C. riparia. Förutom de i Sterner 1933 nämnda fyndorterna föreligga följande: Ålem: 1 km Ö om Linjelund (lägenhet mln Näversjö och Vitsten); Långemåla: 1 km NV om Getebro (av Domänstyrelsen fridlyst lokal); Bäckebo: 1 km S om Brånarna vid foten av åsen.

C. vaginata. Anmärkningsvärda utposter från det rika utbredningsområdet i norra Småland äro Älghult: Barkahult i lundbacke på åbrinken, Höneström »Uva-klöva» i ravinen.

Carlina vulgaris ssp. *intermedia* är iakttagen på spridda ställen i hela området, dock Älghult: 0.

Cirsium heterophyllum är allm. ännu i Åsheda och Älghult samt i västra delen av Kråksmåla. Gränsen mot Ö är ovanligt skarp. Östligaste lokaler äro Långemåla: Alsterhus på åns södra sida 1 km V om gården; Ryssby: Fanketorp vid Norrebäcken V om byn; Bäckebo: 0!

Cotoneaster integerrima. En enda lokal i områdets utkant, Fagerhult: Ärhult på grönstensberg.

Crataegus curvisepala är den ojämförligt vanligaste typen (15 lokaler

ännu i Älghult!). Innanför kustsocknarna är *C. monogyna* den sällsyntaste och föreligger klar endast från Långemåla: Hultsnäs och Bäckebo: Stenbrohult. Sällsyntare inåt är även *C. oxyacantha*, men är dock känd från 4 lokaler i Bäckebo och 2 i Kråksmåla samt från Älghult: prästgården och Hälleberga: Bredaryd. Omvänt tycks förhållandet vara med *C. calycina*, som ännu knappast är observerad i kustsocknarna men iakttagits på 4 lokaler i Älghult.

Crepis praemorsa är endast känd från Älghult (6 lokaler). Den växer i regel i *Arnica*-ängen.

Cynanchum Vincetoxicum. En oväntad förekomst var Ryssby: 2 km V om Ebbegärde vid Snärjebäcken, drygt en mil från kusten.

Daphne Mezereum. Endast observerad i Älghult vid Hoaskruv (mkt spars.) och NO om Stenbrohult vid Badeboda-ån, ett rikt bestånd. Detta är utposter från den rika utbredningen i det höglänta området i norr.

Draba muralis är ej sälls. i kustbandet. En anmärkningsvärd, isolerad inlandslokal är Ryssby: Fanketorp på hällmark.

Drosera anglica. Enda lokaler äro Högsby: mln Stora och Lilla Sinnern samt Älghult: Store Göl.

Dryopteris dilatata är förvånansvärt sällsynt. Några kustlokaler föreligga men i inlandet endast Bäckebo: Lilla Skedsbygd.

Epipactis atrorubens tycks vara ganska allm. N om området i socknarna Mörlunda, Fågelfors och Högsby. Denna utbredning fortsätter något in i undersökningsområdet, och arten är iakttagen flerst. i norra delen av Långemåla, där den främst uppträder på Högsbyåsen i mager tallskog, samt i Fliseryd: Flisbro och Kråksmåla: Rävbacken (Nyström).

E. Helleborine. Flerst. i Fliseryd, Ålem, Långemåla, Bäckebo och Kråksmåla. Dessutom Ryssby: 1 km V om Persmåla; Högsby: Basthult (Blomgren); Älghult: Ideboås.

Erica tetralix. Artens utbredningsområde i sydöstra Småland kan vidgas ett par mil åt NO genom en klunga lokaler Ö om Allgunnen i Långemåla: Bruddegöl, St. och L. Skärsgöl (Blomgren), Örkullagölen och Rävemossen V om Skärsgölarna. Dessutom kunna meddelas Älghult: Torksagöl och Madesjö: Abbegöl.

Eriophorum latifolium. Samtliga lokaler i området: Ryssby: Skäggenäs Venenäs och S om Rev (Sterner 1933), V om Fanketorp vid Norrebäcken; Högsby: Aboda (Blomgren); Älghult: vid Alsterån 2 km SO om Höneskruv, Höneskruv, Gillbonderyd.

Euphrasia micrantha är endast känd från Älghult: Fröseke by.

Fagus silvatica. Inom Långemåla: Hornsö kronopark och angränsande enskilda skogar finnas flerst. smärre bestånd och enst. träd, särskilt kan framhållas skogspartierna N, Ö och S om Böta kvarn samt vid Getebro. Andra lokaler äro Ryssby: 1 km S om Ebbegärde, ett mindre bestånd; Fliseryd: V om Kärnebo och vid Mjölerum, några stora träd; Kristvalla: Östingstorp, ett stort träd i en hage; Bäckebo: Bönemåla, flera ovanligt ståtliga träd, som äro fridlysta; Älghult: Lundby, flera stora träd.

Festuca gigantea. Samtliga lokaler i området: Ålem: mln Näversjö och Vitsten; Högsby: Aboda (Blomgren); Bäckebo: Bönemåla; Kråksmåla: Branthult (Blomgren).

Filipendula hexapetala. Flerstädes vid kusten och utmed Högsby-åsen genom Ålem, Långemåla och Högsby. I övrigt sälls. Långemåla: S om Böta vid »Lersumparna»; Högsby: ödetorp Ö om Högelid; Bäckebo: Mjösingsmåla; Kråksmåla: Branthult, Fröskelås och Mjöshult; Älghult: Höneskruv.

Fragaria viridis. Allm. i skärgården och flerst. vid kusten, följer åsarna inåt land, främst Högsby-åsen men även smååsar såsom Fliseryd: Råsten och Åselid; Bäckebo: Brånarna och Mjösingsmåla; Långemåla: Hultsnäs. Dessutom några inlandslokaler på morän: Ålem: Idhult och Hundhult; Bäckebo: Ekenäs; Kråksmåla: Bölemåla och Branthult.

Galium odoratum. Jfr inledningen. Långemåla och Bäckebo: flerst.; Ålem: S om Vitsten; Ryssby: S om Ebbegärde; Högsby: Hästenäs; Kråksmåla: Branthult.

G. hercynicum. Lokalen Älghult: Hovgården, hagmark, utgör en långt framskjuten utpost mot NO från artens hittills kända utbredningsområde.

Gentianella Amarella är endast känd från Långemåla: S om Värlenäs och Älghult: Fröseke by, i bägge fallen i örtrik *Nardus*-äng.

G. campestris är allm. i Älghult och Kråksmåla och i västra delen av Bäckebo. I övrigt sälls. Fliseryd: Åselid (f. *germanica*); Ryssby: Fanketorp; Åby: Knarrebo N om p. 60,5; Kristvalla: Räggekulla; Långemåla: N om Åbron.

Geranium silvaticum. Frekvensen avtar hastigt ut mot kusten. Allm. i Älghult och Kråksmåla, flerst. men i regel spars. i norra delen av Långemåla och i angränsande del av Högsby. I Bäckebo endast S om nya prästgården. Dessutom några spridda lokaler, Ryssby: Skäggenäs Rev och Åby: Fröstingstorp (Sterner); Kristvalla: N om Skårebo.

Geum hispidum måste numera betecknas som allm. i större delen av området och särskilt i östra delen av skogsbygden, där den framförallt uppträder vid mossodlingar. Den har emellertid ännu icke kommit långt V om länsgränsen, i Älghult iakttagen endast vid Ideboås (redan 1920!) samt Krokshult och Stenbrohult.

Gymnadenia conopsea visar en typisk inlandsutbredning och tillhör *Arnica*-ängens karaktärsarter. Allm. i Älghult och Kråksmåla och flerst. i västra delen av Bäckebo. För övrigt i området endast Långemåla: S om Böta vid »Lersumparna»; Ryssby: Fanketorp; Kristvalla: N om Skårebo och V om Slättingebygd samt Ryssby: Skäggenäs Korsgården och Åby: Sporsjö (Sterner).

Hedera Helix är ganska vanlig ännu i skogsbygdens östra del men avtar sedan hastigt västerut. Västligaste lokaler äro Kråksmåla: 1 km SO om Branthult; Högsby: Keanäs och Hästenäs; Bäckebo: N om Abbegöl vid Madesjö-gränsen och nära länsgränsen.

Holcus mollis är täml. allm. ännu i Älghult och Kråksmåla.

Hypericum montanum når med några utposter från det rika utbredningsområdet i N in i området. Fagerhult: Övraholm; Kråksmåla: V om Branthult (Nyström); Bäckebo: Ekenäs, St. Boksryd; Älghult: Ö om Ideboås, Ö om Djuphult.

Juncus squarrosus är endast iakttagen i Älghult: 2,5 km SO om Höneskruv vid Alsterån.

Laserpitium latifolium är allm. ännu i Älghult och Kråksmåla.

Lathyrus heterophyllus blir hastigt ganska allm. i områdets NV:a del. Bäckebo: 0; Långemåla och Kråksmåla: 6 lokaler i vardera; Älghult: 11 lokaler.

L. niger är täml. allm. i hela området.

L. vernus är i hela området en viktig karaktärsväxt i lundartad vegetation, anmärkningsvärt nog även i *Calamagr. arund.*-rika skogsbackar.

Leontodon hispidus är allm. i Älghult och Kråksmåla och i västra delen av Bäckebo. Östligaste lokaler äro Fliseryd: Yttre Åby och Bankeberg; Långemåla: Bötterum; Ålem: Rumskulla och Hundhult; Ryssby: V om Fanketorp; Kristvalla: Högerås och Räggekulla.

Linaria repens inkom till Kalmar vid sekelskiftet som barlastväxt och har sedan snabbt översvämmat stora delar av sydöstra Småland. Ända in i Älghult är den numera täml. allm.

Listera ovata är tydligt mindre sälls. i inlandet än i kustlandet, i Bäckebo 3 lokaler, i vardera av Kråksmåla och Älghult 6.

Lonicera Xylosteum blir allmännare i inlandet, i Bäckebo 6 lokaler, i Kråksmåla 10 och i Älghult 20.

Lotus uliginosus. Bäckebo: Skillerhults åmader vid Snärjebäcken i en örtrik kärräng långt från bebyggelse och odling.

Matteuccia Struthiopteris. Den enda lokalen i området, Älghult: bäckdalen S om kyrkan, är en mot S starkt framskjuten utpost.

Melampyrum cristatum är täml. allm. i Bäckebo och funnen flerst. i Långemåla och Kråksmåla. I inlandet dessutom Älghult: Sjöamåla, Krokshult och N om Krokstorp samt Hälleberga: Bredaryd.

M. nemorosum. Några inlandslokaler äro anmärkningsvärda, Fliseryd: Släthult; Långemåla: SV om Bötterum; Ålem: Idhult.

Melandrium rubrum, som finns flerst. i skärgården och vid kusten, är icke iakttagen i inlandet.

Melica uniflora. Spridda lokaler i samtliga socknar utom Älghult.

Mercurialis perennis spelar en oväsentlig roll i lundvegetationen och är endast iakttagen i kustlandet.

Monotropa hypophegea. Ryssby: S om Ebbegärde; Långemåla: S och Ö om Böta kvarn.

Narthecium ossifragum. Några lokaler i södra Älghult och lokalen Madesjö: Abbegöl innebära ingen nämnvärd förskjutning av den förut kända utbredningsgränsen mot NO.

Neottia Nidus-avis. Följande uppgifter föreligga: Ålem: Ö om Näversjön, S om Vitsten, 1 km NO om Hundhult; Bäckebo: Ekenäs, N om Brånarna; Älghult: vid sjön Trehörningen (Kjellmark enl. Hård).

Nuphar pumilum. Högsby: norra delen av Allgunnen 1919.

Oenanthe aquatica. Fliseryd: Grönsjön, Finsjö stn; Långemåla: Hultsnäs äro för närvarande de enda lokalerna i området.

Orchis angustifolia. Enda lokalen i området är Madesjö: Abbegöl.

O. mascula Älghult: Sjöamåla, mycket spars. i fuktäng vid gården.

Origanum vulgare är anmärkningsvärt sälls., Fliseryd: Kärnebo; Mönsterås: Långsrum (läroverksadj. Domeij, Mönsterås); Långemåla: Lamnehult och Bötterum på åsen.

Osmunda regalis uppträder på spridda ställen i de större vattendragen, dock ej sedd i Älghult.

Papaver Argemone och *dubium* äro stora sällsyntheter och i inlandet endast iakttagna ett par gånger ruderat.

Phleum Boehmeri följer troget åsarna. Dessutom Kråksmåla: Bölemåla på morän, som är västligaste lokalen.

Pinguicula vulgaris är anmärkningsvärt sälls. Samtliga lokaler: Ryssby: Skäggenäs Korsgården och Rev (Sterner 1933), Fanketorp; Bäckebo: Skåningsmåla; Kråksmåla: Grönskåra, Isabo och Strömsrum (Nyström); Älghult: S om prästgården, Barkahult, Höneskruv.

Platanthera chlorantha är sälls. men visar ingen ojämnhet i utbredningen.

Poa palustris är av allt att döma sälls. och hittills endast iakttagen i Bäckebo, Kråksmåla och Älghult.

Polygonatum multiflorum hör till de lundarter, som blir avgjort rikligare västerut, i Älghult 12 lokaler.

Polygonum dumetorum är täml. allm. i kustlandet och i östra delen av skogsbygden, i Kråksmåla 2 lokaler, i Älghult 0.

P. viviparum. Enda uppgifter äro Älghult (enl. Scheutz' egenhändiga ant. i sitt ex. av Smålands flora); Åsheda: Tånga och Ekhorva (Brundin enl. Hård).

Potamogeton polygonifolius är i områdets västligaste del sedd flerst. Östligaste lokal är Långemåla: Nyckelven (Blomgren).

Potentilla arenaria är allm. i hela området såväl på åsarna som på morän.

P. Crantzii. Enda lokalen, Älghult: Norramåla i *Sieglingia*-äng, är en anmärkningsvärt sydlig utpost.

P. reptans. Enda lokaler i inlandet äro Bäckebo: 2,5 km SV om Ruggstorp på vägkant och Kråksmåla: Strömsrum på en dammvall vid ån (Nyström).

P. Tabernaemontani har spridda lokaler i hela området mest på åsarna men är sällsyntare i inlandet.

Prunus Padus är allm. endast i Älghult och västra delen av Kråksmåla och når knappast ned till kustlandet. Östligaste lokaler äro för närvarande Långemåla: Brusemåla; Ryssby: Fanketorp.

P. spinosa minskar hastigt i frekvens vid länsgränsen. I östra Älghult dock ännu täml. allm. Gränslinjen går över Gillbonderyd, Älghults by, Hovgården och Ideboås.

Pulmonaria officinalis v. *obscura.* Spridda lokaler i kustlandet och östra skogsbygden. Västligaste lokaler Bäckebo: Bönemåla och Kråksmåla: Branthult. Långemåla: 0.

Quercus petraea. Mer eller mindre typiska träd äro sedda flerst. inom Långemåla och Kråksmåla, mellanformer äro vanliga i hela skogsbygden.

Ranunculus polyanthemos är ganska vanlig ännu i Älghult, ingår där ofta i *Arnica*-ängen.

R. trichophyllus. I skogsbygden endast Långemåla: Skälbrobäcken 2 km S om Värlenäs (ut. flytblad).

Ribes alpinum tycks vara allm.–täml. allm. i hela området.

Rosa canina blir hastigt sälls. inåt skogsbygden och är ej iakttagen i Älghult, medan *Afzeliana-* och i högre grad *tomentosa-* och *mollis*-former där äro ganska vanliga.

R. majalis. Följande lokaler, starkt framskjutna utposter från den rika

utbredningen i norr, äro kända, Långemåla: Böta göls sydända; Högsby: Hästenäs; Bäckebo: Fårholmen 2 km SO om Uddevallshyttan; Älghult: Barkahult vid ån, Höneström vid ån, Sjöamåla.

R. rubiginosa. En anmärkningsvärt isolerad inlandslokal är Bäckebo: Brånarna på åsen.

Rubus. Moriferi veri och *Caesii* kunna i kustlandet och i östra delen av skogsbygden traktvis uppträda i betydande individrikedom. Längre in avtar såväl denna som artbeståndet (und. *R. nessensis*) mycket snabbt. I Älghult är en enda lokal funnen, nämligen för *R. Wahlbergii* vid Krokstorp strax V om länsgränsen. För *Moriferi veri* kunna följande västligaste inlandslokaler meddelas. *R. plicatus:* Kråksmåla: Uvahult; Bäckebo: Överstahult; Madesjö: Torstorp. *R. radula:* Långemåla: Alsterhus Strömsholmen; Ålem: vid vägen till Idhult fr. Skälleryd. *R. sulcatus:* Långemåla: Böta kvarn och vid p. 86,1 Ö om Böta göl; Bäckebo: Uddevallshyltan. *R. thyrsanthus:* Högsby: Keanäs, Tortebo; Kråksmåla: Branthult. — Av *Caesii* torde *R. aureolus* ha den högsta frekvensen och i stort sett nå längst in; västligaste lokaler äro Fagerhult: Björkshult; Kråksmåla: Uvanäs; Bäckebo: St. Boksryd. Förutom den i östra delen ganska vanliga *R. Wahlbergii* äro *R. Fioniae* v. *benefixus* och *R. gothicus* iakttagna på enstaka platser i skogsbygden.

Rumex domesticus. Samtliga lokaler: Mönsterås: hamnen (Sterner); Långemåla: Hultsnäs vid en bäck, Böta betesmark; Kråksmåla: Grönskåra vid sågen (Nyström), Uvahult vid en gård; Älghult: 5 utspridda lokaler.

R. Hydrolapathum. Enda lokalen är Älghult: Höneskruv i bäcken.

Sanicula europaea. Flerst. ännu i Långemåla och Bäckebo; Kråksmåla: Branthult; Älghult: 0.

Satureja Acinos. Från områdets västra del föreligga följande lokaler: Fagerhult: flerst. i SÖ; Kråksmåla: Branthult, Torshult; Älghult: Djuphult; Bäckebo: St. Boksryd.

Scheuchzeria palustris tycks vara förvånansvärt sälls. Långemåla: Berkeven vid Herrstorp, L:a Råsgöl.

Scirpus acicularis. Enda lokalen är Högsby: Basthult vid L:a Sinnern (Blomgren).

S. Hudsonianus. Kråksmåla: Mjöshult 1920; Älghult: Flöxhultsgölen.

S. pauciflorus är ej sedd i skogsbygden.

S. silvaticus är anmärkningsvärt sälls. Ålem: S om Vitsten; Långemåla: V om Getebro, Bötterum; Bäckebo: S om Brånarna; Älghult: S om prästgården, Höneskruv.

Sedum annuum blir mot NV allt vanligare. Sydligaste lokaler i området äro Ålem: Ödebo; Bäckebo: Skillerhult och Mjösingsmåla.

Selinum carvifolia. Endast följande inlandslokaler föreligga: Bäckebo: S om Luvehult; Kråksmåla: Fröskelås; Älghult: Barkahult på åbrinken.

Senecio Jacobaea är sedd flerst. ännu i Älghult.

Serratula tinctoria. En genom sin isolering märklig inlandslokal föreligger, Älghult: Höneskruv och flerst. på åbrinken ett par km åt Ö.

Silene nutans når ej långt in från kusten. Långemåla: Flasgölerum; Högsby: Hästenäs; Bäckebo: Ekenäs, Abbetorp, Mjösingsmåla.

Sium latifolium. I inlandet endast sedd vid Bäckebo: Eskilshult.

Sparganium Friesii. Högsby: Allgunnen; Älghult: mln Älgasjön och Hoaskruv.

S. ramosum ssp. *microcarpum.* Enda lokaler i inlandet äro Långemåla: Ö om Bötterum, Skälbrobäcken 2 km S om Värlenäs, Böta.

Spergula vernalis. Flera lokaler ännu i Kråksmåla och Älghult.

Stellaria Alsine blir först i Kråksmåla och Älghult täml. vanl.

S. Holostea. En ganska isolerad inlandslokal är Ryssby: Fanketorp. Dessutom av allt att döma förvildad vid Bäckebo: Kättilstorp.

Taxus baccata. Västligaste lokaler äro Kråksmåla: ca 2 km V om Mossberga, spridda ind. och grupper (Nyström); Älghult: Ideboås (fridlyst).

Teesdalea nudicaulis. Tvenne anmärkningsvärt isolerade inlandslokaler: Kråksmåla: Tämshult (Nyström); Bäckebo: Geltorp, vägkant.

Thalictrum simplex har utpräglad inlandsutbredning. Bäckebo: S om nya prästgården; Kråksmåla: Branthult; Älghult: 6 lokaler.

Thesium alpinum, som har enst. lokaler vid kusten, blir mot NV allt vanligare. Bäckebo: N om Näversjö vägkant; Kråksmåla: mångenst. särsk. i NV; Älghult: endast i norr.

Thymus Serpyllum blir sälls. inåt land utom på åsarna, Älghult: 0.

Trifolium aureum blir i inlandet alltmer sälls. och bunden till åkerbackar, vallar och ruderatlokaler. Älghult: Djuphult i gammal vall, Ideboås vägkant.

T. montanum. Västgränsen är skarp; täml. allm. ännu i västra Bäckebo och Kråksmåla; i Älghult: Sjöamåla, Fröseke by, Krokshult och Höneskruv; Hälleberga: Bredaryd.

Trollius europaeus. Endast i inlandet och där sälls. Östligaste lokaler: Långemåla: Hultsnäs och Bötterum; Bäckebo: Bönemåla och Millemåla.

Valeriana officinalis. Mångenst. ännu i Älghult.

Verbascum nigrum blir hastigt sälls. inåt skogsbygden. Bäckebo: 7 lokaler; Kråksmåla: Branthult (Nyström); Älghult: Hovgården, Botillabo åkerkanter.

Veronica hederifolia. Anmärkningsvärda inlandslokaler äro Bäckebo: Torskemåla, Abbetorp och Mjösingsmåla; Älghult: Sjöamåla.

V. verna tycks snarast bli vanligare västerut. Älghult: 12 lokaler.

Vicia cassubica är allm. ännu i Älghult.

V. dumetorum. Kråksmåla: en sluttning V om Branthult (Blomgren).

V. silvatica flerst. i samtliga inlandssocknar.

Viola mirabilis blir avgjort vanligare västerut. Bäckebo: 10 lokaler; Älghult: 25 lokaler.

V. montana tycks utan tydlig gräns gå över i *V. canina.* Mellanformer äro ganska vanliga i så gott som hela området, men mera typiska ind. endast i Älghult.

V. rupestris v. *arenaria.* Ett fåtal inlandslokaler. Fliseryd: Råsten och Åselid, på åsen; Ålem: Nylund på åsen; Bäckebo: Ekenäs och L:a Skedsbygd, på morän; Älghult: Hoaskruv, morän, Höneström, isälvsgrus.

V. stagnina. I inlandet spridda lokaler på sjöstränder och vid vattendragen.

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NOTES ON THE FLORA OF THE GASPÉ PENINSULA.

BY

OLOF RUNE.

Introduction. The region surrounding the Gulf of St. Lawrence in E. Quebec has long attracted the attention of botanists on account of several problems relating to the distribution of various members of its flora. This applies especially to the Gaspé Peninsula the flora of which was fairly closely studied by M. L. Fernald and his co-workers at the beginning of this century. Fernald noticed that a great number of plants appeared disjunctively in that area, viz. (1) arctic plants with a disjunct southern outpost there, and (2) western plants with their main distribution in the North American Cordillera and a few isolated stations in the Gulf of St. Lawrence district. In addition, he described several new species, i.e. endemics of that area. Still, in several cases the latter refer to isolated populations that differ but slightly from the main populations and do not invariably justify classification in a species of their own.

On the basis of these inquiries, Fernald, in 1925, published his now famous phytogeographic study, *Persistence of Plants in Unglaciated Areas of Boreal America*. He attributed the peculiar distributions in the St. Lawrence district to the incomplete glaciation of that district during the Pleistocene. However, the idea of arctic and boreal biotas surviving pleistocene glaciations on icefree refugia within the range of glaciation was not entirely new. In Scandinavia, Sernander (1896), Hansen (1904), Wille (1905), and Th. Fries (1913), among others, had proposed a similar explanation. However, a so-called nunatakk hypothesis had not been discussed in detail prior to Fernald. His hypothesis was substantiated by the geologic reasoning of his time, according to which the

highest peaks of Gaspé had remained untouched by the Wisconsin ice (Coleman 1922). Further studies in geology and botany have shown the problem to be more complex than Fernald had thought. Today, non-glaciation no longer derives any support from geologists in the alleged nunatakk areas (Alcock 1935, 1944; Flint *et al.* 1942). The isolated position of the Gaspé flora has become less conspicuous through new finds of plants in Labrador and in the interior of Canada. Though not completely disproved, Fernald's hypothesis cannot today be regarded as adequate in its original form. Although several interesting views of these phytogeographic problems have been submitted during the past decades, no conclusions can as yet be drawn, considering that present knowledge is still too limited to form the basis of a convincing theory.

The purpose of the present paper is to provide a brief summary on a subject relating to certain important problems also in Scandinavian phytogeography. In addition, some observations made by the author during an excursion to Gaspé in the summer of 1951 are reported with a view to shedding light on the ecologic conditions of life of these phytogeographically important species in the field. My investigations chiefly concerned the serpentine area of Mt. Albert, the only part available for closer study. A brief report on the serpentine flora of Mt. Albert has been published earlier in a work concerning the serpentine flora in the North of Sweden (Rune 1953).

The Gaspé Peninsula, with an area of approximately one-third of Sweden, lies on the southern side of the Gulf of St. Lawrence (Lat. about 49° N). In spite of its more southern latitude, the area resembles N. Scandinavia in climate and phenology. Its interior consists of a wild, rugged forest land formed by the Shickshocks which represent the northernmost region of the Appalachian mountain system. Only its highest peaks reach above the timber-line, situated at a level of about 1200 m. Accordingly, real alpine country is comparatively rare in Gaspé. On the northern coast, this rugged country slopes abruptly down towards the St. Lawrence river, there forming a rocky coastline. Towards the South, the Shickshocks proceed in gently undulating slopes into the flat coastal plain fringing the Chaleur Bay. As regards the geology, the following may be quoted from Guide Book No. 1 of the Geol. Survey of Canada (1913): "Generally speaking, Gaspé is a region of regular appalachian folds and intensive overthrusts of the older Palaeozoic strata, the extraordinary displacements which have been largely concealed by a mantle of later (De-

vono-Carboniferous) nearly horizontal sandstones and conglomerates."

The flora of the forest lands in Gaspé is more trivial than that of the high mountains and coastlines. Botanical interest is, therefore, largely focussed on the sea cliffs and rocky headlands of the northern coast; on the rivers of the southern coast that drain the mountains of the interior and the greater part of the peninsula; and, above all, on the highest mountains of the interior.

Mt. Albert. The height centre of the Shickshocks is formed by two adjacent high mountains, Mt. Jacques Cartier and Mt. Albert. The first-mentioned is better known in botanical literature as Table Top, a name actually more suited to Mt. Albert, having a vast plain-like summit more than 5 km in length and 4 km in breadth. Nearly the whole of Mt. Albert consists of serpentinized peridotite surrounded by dark amphibolite, which also builds up the northern slopes and appears as a fringe along the northern edge of the plateau (Pl. I).

The border-line between serpentine and amphibolite is clearly marked out by a very sharp vegetational boundary (see Fig. 49 in Rune 1953). The amphibolitic ground is covered by a close growth of shrubby spruce and balsam fir (*Picea mariana*, *P. glauca*, and *Abies balsamea*). Here the mineral soil is covered by a dense, continuous carpet of mosses, principally *Pleurozium schreberi* and *Hylocomium splendens*, with a mighty raw-humus layer underneath. This type of vegetation ceases as soon as the serpentine soil is reached which is devoid of trees and closed vegetation. The whole serpentine plateau appears as a desert, nearly destitute of vegetation. The strange appearance of this vast area is accentuated by the bright yellowish brown colour of the weathered serpentine rock. It can be easily understood why its discoverer, A. P. Low, the Canadian geologist, described this view as "a picture of the moon" (Low 1884).

However, seen at close range, the barren uniformity of the serpentine table-land breaks up into various habitats, all harbouring plant communities seemingly reminiscent of those seen in arctic and high-alpine regions. The similarity is, no doubt, due to the intensive frost action in this serpentine ground — its highly congeliturbate character being noticed by the abundance of stone polygons, frost scars, solifluction lobes, etc., spread all over the table-land (Pl. I).

The soil conditions of the Mt. Albert table-land are exceptional at that altitudinal level and are not found elsewhere in Gaspé. However, similar soil conditions seem to prevail in the serpentine areas of SW. Newfoundland (cf. FERNALD 1911) and in many serpentine areas of northern Scandinavia (RUNE op. cit.). In view of the obvious influence of intensive frost action on the flora of Mt. Albert, I propose to dwell somewhat upon the factors underlying this phenomenon.

As regards the table-land of Mt. Albert, the following factors may be responsible for the intensive frost action in its soil, irrespective of their order of significance: (1) sparse vegetation, (2) mechanical composition of serpentine soil, and (3) the horizontal bedrock underlying the serpentine soil.

As regards (1), it is clear that the intensity of frost action varies inversely with the thickness of the peat or turf covering the mineral soil. According to HOPKINS & SIGAFOOS (1950), "two factors are involved in this relationship: (1) Ice lences form more abundantly in silty mineral soil than in peat, probably because water is drawn less rapidly through the large openings that predominate in the peat and because the tough, fibrous structure of the peat resists disruption by growing ice crystals and (2) silt is a much better heat conductor than peat or turf. Summer thaw penetrates much deeper into the bare mineral soil than into the peat, and severe autumn frosts produce several inches of frozen ground in bare areas, whereas only the subaerial portion of vascular plants are frozen in dry turf a few inches away" (op. cit. p. 61). The same authors conclude (l.c. p. 62): "Frost heaving in bare areas or areas covered with isolated plants is more intense than in areas covered with a dense vegetation. The tightly interlocked roots and stems form a dense mat of vegetation that resists expansion at the surface and an insulating blanket that retards freezing of the underlying soil."

On the other hand, the intensive frost action in the bare soil will postpone colonization and prevent the formation of a closed vegetational mat. Generally speaking, the interplay between intensive frost action and the vegetational pattern is a rather complex matter. Moreover, the same phenomenon — a pioneer vegetation in a state of equilibrium on a congeliturbate — may result from different factors. This is fairly well illustrated in serpentine. Its soil is known to be unfavourable to most plants. Consequently, it usually withstands invasion by climaxes even in areas where the frost action is eliminated.

The infertility is due not only to low nutritional content but also to comparatively high contents of nickel and chromium (Rune op. cit.). The ability to survive on serpentine is restricted to rather few species, or ecotypes of the species, and several plants that are ubiquitous and aggressive outside the serpentine area cease immediately on reaching serpentine soil. Thus, the barren appearance of the serpentine is primarily contingent to the chemical composition of the soils which makes them infertile for most plants.

For this reason, the serpentine areas of the North, e.g., in N. Fennoscandia and Gaspé, usually exhibit a surface free from the more or less continuous mantle of humus and mosses covering the ground elsewhere in these cold and humid provinces. Being, as a rule, very exposed and lacking thickets of shrubs and tall herbs in which the snow drift can accumulate, the serpentine areas are less snow-covered than their surroundings. Apparently, the scarce vegetation on serpentine contributes to the intensive frost action also in forest districts where the well-protected ground usually remains rather stable.

The instability of the soil surface caused by congeliturbation will no doubt affect vegetation in accentuating the unfavourable conditions in serpentine. As the churning and mixing of the soil caused by congeliturbation brings "fresh" infertile serpentine soil up to the surface, the concentration of soluble poisonous compounds cannot decrease in the rhizosphere through leaching or oxidation — not to mention the direct destruction of many plants in connection with very intensive congeliturbation.

The serpentine rock weathers rather slowly, producing a yellowish brown silty soil whose texture seems to vary but slightly, even in widely different areas (Rune op. cit.). The mechanical composition of this soil does not allow satisfactory internal drainage (cf. Robinson *et al.* 1935). Further, resting, as it mostly does, straight on the bedrock at a shallow depth, the soil is continually moist in horizontal and gently sloping areas during seasons with low evaporation, viz., during the repeated freeze-thaw cycles of late fall and early spring.

It should be borne in mind that frost-heaving and frost-thrusting are due to a volume increase in masses of soil owing to the segregation of masses of clear ice during the freezing periods and, accordingly, depend on the moist conditions in the soil.

As regards the vast, flat table-land of Mt. Albert, the horizontal bedrock which is usually situated at a depth of a few feet favours an

intensive frost action in the same way as the perennially frozen ground of the Arctic, i.e. it inhibits subsurface drainage and maintains moist conditions during the freezing periods (cf. Hopkins & Sigafoos op. cit.).

Thus, a physiognomic resemblance does actually exist between the table-land of Mt. Albert and the Arctic tundra (cf. Polunin 1948, Porsild 1951), referring rather to ground conditions and topography than to climate. As already mentioned, the vegetation on the Mt. Albert table-land is not uniform but differentiated according to the various types of habitats. The exposed areas, being less protected by snow during the freezing season, are subjected to an intensive frost action. In such places, the soil usually dries during the vegetational season. On the most extreme congeliturbate, viz., at the central parts of stone polygons, etc., only a few plants can settle, isolated or in small tufts. The following are to be found rather constantly in such habitats: *Minuartia marcescens*, *M. rubella*, *Arenaria humifusa*, and *Artemisia borealis*. Of these, *M. marcescens*, endemic of Mt. Albert and similar areas in SW. Newfoundland, is extremely abundant. *Artemisia* is locally abundant while the others are comparatively less abundant though very constant in all parts of the table-land.

On the less extreme congeliturbate, e.g., among the boulders at the peripheral parts of stone polygons, etc., *Rhododendron lapponicum* is particularly plentiful. This applies also to *Carex scirpoidea* which, as a matter of fact, is a common plant everywhere on the Mt. Albert serpentine.

Broadly speaking, the above-mentioned types of habitats may be compared to so-called tundra barrens (Polunin op. cit.) and dry or high tundra (Hopkins & Sigafoos op. cit.).

In depressions and other areas less exposed to the wind, the intensity of frost action decreases, the ground being insulated from the cold air by the snow layer. In these areas the soil does not dry up during the vegetational season and in some places the ground is even swampy. These types of habitats seem to correspond to the tundra marshes described from the East American Arctic by Polunin (op. cit.) and to the so-called low tundra of Hopkins & Sigafoos (op. cit.). These parts of the table-land are covered by a mat of vegetation that is broken up here and there by frost scars and solifluction lobes. The ground layer is formed by the moss *Rhacomitrium lanuginosum* which is by far the most abundant plant of the table-land. One of the most characteristic plants of this tundra marsh,

Armeria scabra ssp. *labradorica*, is strictly limited to this type of habitat on Mt. Albert. Other important components of this vegetation are: *Deschampsia alpina*, *Carex scirpoidea*, *Scirpus caespitosus*, *Juncus trifidus*, *Viscaria alpina*, *Betula glandulosa*, *Rhododendron lapponicum*, *Vaccinium uliginosum* var. *alpinum*, *Ledum palustre* ssp. *groenlandicum*, and *Andromeda glaucophylla*.

Besides the plants mentioned above, a few others can be classified as highly characteristic of the serpentine table-land without being restricted to any special type of habitat there.

The following list contains the most characteristic vascular plants of the serpentine table-land of Mt. Albert (in order of abundance). [Remarks on frequency and distribution refer only to the serpentine table-land of Mt. Albert.]

Minuartia marcescens, abundant, ubiquitous
Rhododendron lapponicum, abundant, ubiquitous
Carex scirpoidea, abundant, ubiquitous
Cerastium arvense var., abundant, ubiquitous
Viscaria alpina, rather abundant, ubiquitous
Campanula rotundifolia var. *langsdorfiana* Britton (cf. Scoggan 1950), rather abundant, ubiquitous
Armeria scabra ssp. *labradorica*, abundant on moist ground
Artemisia borealis, abundant on barren, congeliturbate ground
Arenaria humifusa, rather abundant on barren, congeliturbate ground
Minuartia rubella, as the preceding plant
Silene acaulis var. *excapa*, as the preceding plant, but less abundant
Salix brachycarpa, frequent, ubiquitous
Minuartia biflora (*Arenaria sajanensis*), sparse on barren ground, mentioned here because of its disjunct occurrence on Mt. Albert (cf. Rune op. cit. p. 97).

In the Mt. Albert table-land, a deep gorge called Devil's Gulch runs from the south towards the centre where it splits up into several small ravines. The steep walls of the latter are largely covered with unstable scree, and lack closed vegetation. The bottom of these ravines, on a level of about 1000 m, harbours a dense growth of shrubby spruce, balsam fir and birches (*Betula cordifolia*, *B. borealis*). In the proximal part of the main ravine, the brooks have combined to a shallow river fringed by barren flats of gravel outwash. Occasionally, plants characteristic of table-land are found on these

flats. Otherwise, the flora of the ravines differs somewhat from that of the table-land. Between the boulders of the steep slopes three ferns with an interesting distribution are noted, viz., *Polystichum mohrioides* var. *scopulinum*, *Cheilanthes siliquosa*, and *Adiantum pedatum* var. *aleuticum*. The first two are comparatively sparse, being restricted to part of a slope facing south, while the latter is rather abundant on Mt. Albert serpentine, occurring also in sheltered places of the table-land (Pl. I).

Also the following plants from these ravines should be included in this report: *Festuca scabrella*, *Danthonia intermedia*, *Castilleja septentrionalis*, *Solidago chlorolepis*, *S. multiradiata*, *Aster foliaceus*. The distribution of the latter two is arctic-boreal American, that of the others disjunct American. The local endemic *S. chlorolepis* is an eastern representative of the Cordilleran *S. decumbens*. In the ravines some rare birch species are seen, such as *Betula papyrifera* var. *elobata* (local endemic), *B. borealis*, *B. minor*, *B. glandulosa* var. *rotundifolia*. However, these are throughout sparsely represented in their stations.

On Mt. Albert, the interesting plants are not entirely restricted to serpentine. For instance, on ascending the steep amphibolitic northern side, the western *Vaccinium ovalifolium* is met with already in the dense forest at the base. At a higher level, in clearings below the top escarpment, a *Streptopus amplexifolius* var. *oreopolus* appears which is one of the alleged Gaspé endemics whose range has been widened through further investigations. In a similar locality *Polystichum braunii* is found, a beautiful fern with a disjunct distribution in America. In a neighbouring brook ravine, some northern plants occur, viz., *Ranunculus allenii*, *Epilobium anagallidifolium*, *Veronica tenella* (Pl. I).

Finally, the main geographical groups of plants represented in the serpentine of Mt. Albert will be briefly considered.

1. Arctic species with a southern outpost on Mt. Albert:

Deschampsia alpina, *Carex lachenalii*, *Arenaria humifusa*, *Minuartia biflora*, *Viscaria alpina*, *Armeria scabra* ssp. *labradorica*, *Campanula rotundifolia* var. *langsdorfiana*, *Artemisia borealis*, *Solidago multiradiata*.

2. Arctic species with a range extending to the high mountains of New England, though with an occurrence which is probably most abundant south of the Arctic on Mt. Albert:

Carex scirpoidea, Minuartia rubella, Silene acaulis var. *excapa, Rhododendron lapponicum, Vaccinium uliginosum* var. *alpinum, Ledum palustre* ssp. *groenlandicum.*

3. Northwestern species of America with disjunct occurrences in the St. Lawrence Gulf district (FERNALD's Cordillera group):
Polystichum mohrioides var. *scopulinum, Adiantum pedatum* var. *aleuticum, Cheilanthes siliquosa, Festuca scabrella, Danthonia intermedia, Salix brachycarpa, Minuartia marcescens, Solidago chlorolepis, Aster foliaceus.*

Minuartia marcescens, an endemic of the serpentine areas in the Gulf of St. Lawrence, is very closely related to *M. obtusiloba* of the Rocky Mountains. It possibly constitutes a serpentinicolous variety of the latter, having nowadays a more isolated occurrence as a serpentinicolous relic. In addition to this presumably serpentine race, a typical serpentinophyte is found in abundance on Mt. Albert, viz., a specific type of *Cerastium arvense,* disclosing features indicative of serpentinomorphosis, being glabrous, angustifoliate and of a purple colour. The type race of *C. arvense* occurs spontaneously in Gaspé, e.g. on the limestone scree at Cap Bon Ami (Pl. II). A serpentine form of *C. arvense* has been recorded by NOVÁK (1928) from E. Europe. Supposing that this is identical with the present type from Mt. Albert, a remarkable case of parallel evolution would then have manifested itself.

On Mt. Albert, the arctic species, with few exceptions, are restricted to the serpentine table-land. The species of the Cordillera group, on the other hand, occur in the walls and talus areas of the deep ravines.

Disjunct elements, arctic as well as NW. American species, are also to be found on the other high mountains of Gaspé. However, they usually refer to other species than those on Mt. Albert. They are, moreover, very rare in their stations, appearing only in very limited areas. In the Gaspé mountains, Mt. Albert is unique in harbouring these rare plants in abundance and spread over a wide area.

Other mountains of interior Gaspé. First we turn to the neighbouring Mt. Table Top whose plain summit is of granite where we find wide boulder-lands with alpine dwarf-shrub heaths between. The most important plants are these: *Carex bigelowii, Diapensia lapponica, Loiseleuria procumbens, Phyllodoce coerulea, Vaccinium vitis-idaea* v. *minus, Empetrum nigrum,* sparse *Rhododendron lapponi-*

cum, and the very pretty *Potentilla tridentata*, a trivial arctic-alpine plant of North America and Greenland.

These northern species all continue southwards in the Appalachians, some of them being common and widely distributed in the high mountains of New England.

The peak of Mt. Table Top is surrounded by several smaller ones that never quite attain an alpine level and are largely covered with a dense growth of creeping spruce and balsam fir. In these parts the bedrock is often calcareous, and areas protected from shrub-growth and consequent soil degeneration may harbour a rich and peculiar flora. Thus, on the ledges of cliffs facing west and built up of calcareous schist, the following northern plants have been encountered: *Carex rupestris, Campanula uniflora, Saxifraga tenuis, Pyrola grandiflora, Pedicularis flammea*. They all reach their southern limit in Gaspé.

Northwest of the Table Top, in the eastern part of Mont Auclair, a clearing, several hundred metres long, appears in the subalpine spruce forest. This station, referred to by FERNALD as a calcareous meadow, harbours several remarkable plants, viz., *Carex maclovіana, Pyrola grandiflora, Gnaphalium norvegicum*. They are all northern species reaching their southern limit here (Pl. II).

Among the representatives of the Cordillera group, *Agoseris aurantiaca* is the most striking, occurring exclusively in this locality throughout East America. *Festuca scabrella* and *Danthonia intermedia*, reported from Mt. Albert, are also found there. Other members of this group, occurring here, are *Lonicera involucrata, Senecio pauciflorus*, and *Arnica lanceolata*.

This station should rather be described as a subalpine, sloping fen, the ground being periodically flooded. The favourable soil conditions in these stations cannot be attributed to the cropping out of calcareous bedrock. Nor does the moraine seem to differ from that of the surroundings. The calcareous effect is apparently due to mobile subsoil water with a high calcium content.

Mt. Logan situated about 15 miles west of Mt. Albert is another mountain of interest to botanists. Like the other Gaspé mountains this one has a plain table-top and very steep sides with talus areas at their base. This mountain has not been so closely investigated as the others mentioned here, being rather inaccessible and very hard to climb. The bedrock consists mainly of rather calcareous mica schists. The top plateau barely reaches the alpine level and is largely

covered with shrubby spruce. However, alpine ridges of easily weathered schist are to be found on the plateau, and, together with the steep slopes and talus areas, they constitute stations of rare plants.

The most remarkable find on Mt. Logan is undoubtedly *Carex nardina* which grows on bare schist ridges. This is the only station of East America outside the real Arctic. Many other northern plants occur on the ledges and the talus of the steep calcarous schist cliffs, the bulk reaching their southern limit in this station, e.g., *Potentilla hyparctica, Thalictrum alpinum, Draba nivalis, Cerastium beeringianum, Stellaria longipes, Saxifraga tenuis, Dryas integrifolia, Pedicularis flammea, Pyrola grandiflora, Senecio pauciflorus.*

Localities of coastal districts. In addition to the high mountains in the interior of the peninsula, rich localities are to be found in the coastal district, notably in the talus below the steep sea cliffs of the north coast which consist of calcareous sandstone. Extensive areas of scree are to be found at Mont Louis and the adjacent Mont St. Pierre (Pl. II), and more eastwards at Cap Pleureuse. In the scree areas below the neighbouring Mont Louis and Mont St. Pierre, *Astragalus scrupulicola* and *Oxytropis gaspensis* are to be found, both endemics restricted to these localities though closely related to *A. aboriginum* and *O. viscida*, respectively, of NW. America. In addition, the following northern species may be mentioned: *Dryas integrifolia, Elaeagnus commutata, Erigeron compositus.* The sand cherry, *Prunus pumila* var. *depressa*, a psammophilous creeping shrub of the regions of St. Lawrence and the Great Lakes, is very abundant in these scree areas.

On a similar type of scree below the sea cliffs of nearby Cap Pleureuse, *Oxytropis foliolosa* and *Gentiana propinqua* make their appearance in their only known stations south of Labrador and Newfoundland. The former is very closely related to our *O. lapponica.* On limestone talus and the cliffs above Lac Pleureuse the very rare *Carex misandroides* of NE. America is to be seen which is closely related to the arctic *C. misandra.*

Further east, near the point of the peninsula, another type of locality is to be found: limestone cliffs of a varying height, usually situated close to the coast. The most important ones are situated at Cap Bon Ami, Percé, and Bonaventure Island (Pl. II). These stratified limestone rocks weather rapidly under the action of frost and

the solvent properties of rain water, producing sharply cut cliffs with talus slopes at their base. Compared with the north-exposed scree areas of the northern coast, these limestone cliffs offer far warmer and more arid conditions, and northern elements are relatively less to be noted. Most of the Gaspé endemics occur in these localities; the following may be mentioned: *Puccinellia macra* (eastern representative of the Pacific *P. nutkaensis*), *Draba pycnosperma* (local endemic), *Erysimum coarctatum* (Gulf endemic), *Oxytropis johannensis* (representative of *O. campestris* of NE. America, much reminding of our ssp. *sordida*), *Antennaria gaspensis* (local endemic), *Arnica chionopappa* (eastern representative of the western *A. lochopylla*). Some northern species may be mentioned: *Dryas drummondii*, *D. integrifolia*, *Minuartia rubella*, *Potentilla nivea*, *Erigeron compositus*, *Euphrasia arctica*.

The southern side of the Gaspé peninsula is largely forested and rare plants are restricted to river flats and delta deposits at the mouths of the big rivers. They are, taken from east to west: the Grand, Little Pabos, Grand Pabos, Bonaventure, Little Cascapedia, Grand Cascapedia, and Matapedia rivers.

The most easterly rivers, the Grand River to the Bonaventure, in particular, harbour several rare plants. Thus, *Aster gaspensis*, the only representative of the section of *Fulcrati* of East America, has its only known stations on these rivers. On the delta deposits of the Bonaventure River, the endemic *Gentiana gaspensis* has its only station. Its closest ally, the western *G. macounii*, has its easternmost station at James Bay (cf. Raymond 1950 p. 67). In Gaspé, the circumpolar species *Astragalus frigidus* is represented by a particular race, var. *gaspensis*, found at the Bonaventure and the Little Cascapedia rivers. In the West, the species is represented by var. *americanus*. The Arctic American *Astragalus eucosmus*, closely related to our Eurasian *A. norvegica*, occurs, inter alia, in the deltas of the Bonaventure and the Matapedia rivers.

The river deltas also harbour a group of plants not found elsewhere in Gaspé — southern plants with a northern outpost there, e.g., *Rosa virginiana*, *Rhynchospora capillacea*, *Arisaema atrorubens* var. *zebrium*, *Lathyrus venosus* var. *intonsus* (cf. Raymond op. cit.).

The Gaspé Peninsula, which was previously an isolated part of the country, has in the past few years become increasingly invaded by tourists, lumberers and miners. However, the mountains in the

Fig. 1. Highway Route 6 cuts straight through the talus slopes at Mont Louis and other localities of particular botanical interest along the northern coast. — Postcard photograph.

interior of the peninsula still remain on the whole virgin soil. Highway Route 6, which follows the coast round the peninsula, cuts straight through localities of particular botanical interest along the northern coast. Several of the notable species recorded from these parts seem to have disappeared, and the remains are in imminent danger either of being picked by collectors who need only climb out of their cars to get them, or of being overrun by the flora of weeds adhering to the road. The remarkable localities at Percé are threatened by the increasing building activities in their proximity.

Finally, the well-known delta areas at the south coast have been severely damaged by timber-floating and the establishment of saw mills.

Conclusions. The rare elements in the Gaspé flora are restricted to particular habitats, characterized by a basic soil reaction and a vegetation kept at the pioneer stage, viz., cliffs and talus of limestone, serpentine, calcareous schists or conglomerates, and river flats or delta deposits of similar material. In these habitats, invasion by a closed vegetation is prevented by the instability of the soil owing to rapid weathering or scree slip, and, in the case of serpentine, congeliturbation and infertility. This restriction to pioneer habitats applies to nearly all endemic and disjunct Gaspé plants, irrespective of their phytogeographical group.

It is evident that all the present stations of rare Gaspé plants were once covered by the Wisconsin ice. Those of the coastal districts were even submerged in the post-Wisconsin Chaplain Sea.

Accordingly, the rare plants must have immigrated into their present localities either from unglaciated areas further east, e.g., the continental shelf outside E. America, as suggested by Hultén (1937), or from the south by following the retreating ice. Irrespective of their origin, these plants, or their ancestral types, may have followed the waves of pre-climaxes that conquered the new soil. Presumably, they appeared as common and aggressive plants, well adapted to the unstable, barren soil around them.

New finds of arctic plants in the interior of Labrador and also in the mountains of New England have somewhat undermined the conception of an isolation of the arctic element in the Gaspé flora. The actual concentration of several arctic plants in Gaspé may be explained by the rich occurrence of habitats offering edaphic conditions suitable for such plants, viz., the tundra-like serpentine table-land, as well as scree and cliffs of a northern exposure.

It emerges from the present paper that the serpentine table-land of Mt. Albert forms an arctic or high-alpine exclave as regards the appearance of the ground and its vegetation. The latter is dominated by arctic plants, probably early postglacial invaders conserved as serpentinocolous relics owing to the edaphic conditions that inhibit an ordinary climax vegetation. Still, the inaccessibility of serpentine to most plant species no doubt prevents the occurrence of an even greater number of arctic plants in the table-land.

As stated in an earlier publication (Rune op. cit.), the serpentine flora of Mt. Albert has the characteristic feature of a young, i.e. postglacial, serpentine flora, being rich in serpentinicolous relics but very poor in serpentinophytes.

Fundamentally, the significance of the serpentine habitat in regard to the peculiarity of the Mt. Albert flora is evident from the much-overlooked fact that the serpentine areas of, e.g., the Black Lake district in S. Quebec, harbour some of the plants characteristic of Mt. Albert though situated far from the supposed unglaciated areas of the Gulf of St. Lawrence (cf. Raymond op. cit. p. 75, Rune op. cit. p. 95). Further, the resemblance between the floras of these remote areas points to a similar origin. Thus, the early postglacial flora from which the serpentinicolous relics of Mt. Albert are descended must have occurred far beyond the range of the St. Lawrence Gulf districts.

The majority of researchers who have studied problems relating to the flora in the St. Lawrence region since Fernald have attributed considerable significance to the numerous peculiar localities found there, whose lack of a closed vegetation made them suitable refuges for epibiotic elements. Accordingly, Wynne-Edwards (1937) expressed the opinion that epibiotic elements represent postglacial invaders whose soil requirements have not allowed them to spread beyond their present limits. Griggs (1940) pointed out that most rare species find their habitats in the early stages of ecologic succession. He concluded (op. cit. p. 591): "The very remarkable localization of the refuges of rare plants of the shores of bodies of water in the St. Lawrence system, a localization several times greater than could be accounted for by the natural prevalence of pioneer habitats near the shore, would find its explanation on this basis. For because of the several predecessors of the Great Lakes there have been more post-Wisconsin changes in geographical distribution of land and water in this basin than anywhere else in North America. The correlation between the distribution of rare plants and postglacial submergences is too good to be accidental."

The arctic species occurring in the Gaspé region manifest, on the whole, the same ecologic requirements as in the Arctic. That these species in Gaspé are restricted to habitats without a closed vegetation seems natural considering that these plants, as a rule, cannot thrive in a closed vegetation.

This does not apply to the West American species that appear

disjunctively in Gaspé. These species often show a marked distribution and have a wide ecologic amplitude in the West while being strongly specialized ecologically in the East. The narrow ecologic amplitude is certainly due to genetic reasons. It would seem that the eastern populations possess a simpler genetic constitution owing to their vegetational history. The hardships to which they were subject while being forced southwards by the Wisconsin ice-sheet may have substantially depleted the biotype stock, and subsequent inbreeding may in some cases have further sharply defined the species from ancestral types (cf. Cain 1940). Moreover, as pointed out by Stebbins (1942), certain biotypes may have been eliminated through combinations of recessive genes expressing themselves phenotypically as non-adaptive characteristics (cf. Scoggan 1950).

Further light might be shed on the strange history of these species with a disjunct American distribution through a careful study of the ecologic and genetic differences between the populations in the East and West.

For comparison, some well-known localities of rare plants in N. Fennoscandia may be mentioned which ecologically resemble some of the Gaspé stations. They refer to arctic-alpine plants with disjunct occurrences on scree areas or the rocky sides of deep ravines, situated rather at a distance from the high mountain districts.

The scree area of Mt. Habavuoppebakte in Kautokeino in N. Norway provides a striking example by a very disjunct occurrence of *Oxytropis deflexa*. This species, represented there by the endemic subsp. *norvegica*, has its nearest stations in the Altai Mountains and NE. Siberia. The above scree area, consisting of calcareous mica schist, also presents several other rare plants. The rich flora has a strictly local appearance, being surrounded by vast areas of trivial birch forest. It is interpreted as a relic of the richer flora of early Post-Glacial, later overrun by forest communities in the lowlands (cf. Nordhagen 1935).

From the forest-land of Swedish Lapland, a recent find of *Melandrium angustiflorum* may be mentioned (Björkman 1947). This arctic plant was noticed on cliffs and talus in two of the canyons of the Muddus National Park. It is a rare plant throughout Arctic Fennoscandia, being restricted to rather a few localities; those nearest from Muddus are in the high mountains about one hundred miles further northwest.

However, more important localities of the latter type are to be found in E. Kuusamo, NE. Finland (Lat. about 66° N), where canyons and deep ravines, with calcareous rock, occur in an otherwise flat forest-land (cf. Pesola 1928). The big dry-canyon of Jäkälävuoma discloses a great number of arctic-alpine plants, growing in the scree or on the ledges of steep walls. Most of these plants have a very isolated outpost in this station, the nearest finds occurring several hundreds of miles away. The following species from Jäkälävuoma may be mentioned: *Woodsia glabella, Carex glacialis, Salix reticulata, Draba cinerea, Arenaria pseudofrigida, Dryas octopetala, Saxifraga nivalis, S. aizoides, S. oppositifolia, S. groenlandica, Oxytropis campestris* ssp. *sordida, Astragalus frigidus, Thymus serpyllum* ssp. *tanaensis, Arnica alpina.* In addition, a great number of arctic mosses has been recorded from this station.

On the cliffs by the adjacent rapids of Niska are found: *Roegneria scandica, Gypsophila fastigiata, Potentilla chamissonis.*

Like the *Oxytropis deflexa* station, the latter may also be regarded as relic stations, i.e., places where remnants of the early postglacial invaders have withstood later climaxes owing to the edaphic conditions.

In all likelihood, most of the arctic-alpine plants enumerated above survived the last glaciation on ice-free refugia in the coastal districts of N. Norway, i.e., rather distant from their present outposts.

Undoubtedly, many of the nowadays rare arctic-alpine species that survived on Scandinavian refugia or otherwise reached this area during the Late-Glacial, became aggressive invaders rapidly spreading over the early postglacial tundra far beyond the present arctic-alpine barren-lands. However, these species have, as a rule, been unfit for competition in areas later conquered by forest. In as far as they did not disappear entirely, they have only been able to remain in special habitats such as those referred to above.

The Gaspé Peninsula, like N. Fennoscandia, lies within the zone of antagonism between forest and tundra, their line of demarcation having repeatedly moved to and fro during the Post-Glacial. Undoubtedly, Gaspé appeared mainly as an alpine country during the early Post-Glacial, and its lower, calcareous mountains may have harboured a very rich flora. In the end the forest practically completed its conquest of the peninsula. The remains of the early invaders have, nevertheless, here and there managed to evade the

choking grasp of the forest thanks to a great number of steep rock walls and the extensive areas of scree and serpentine of the Gaspé Peninsula.

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Description of the Plates.

Plate I.

Upper: Devil's Gulch, the deep gorge in the serpentine table-land of Mt. Albert. Its steep slopes and talus areas are the stations of several endemic and disjunct plants, restricted to this part of the mountain. In particular, disjunct plants with their main distribution in the West are to be found here. — Photo Olof Rune 12.8. 1951.

Middle: Mount Albert. Northern side seen from the St. Anne valley. The rock of this side is amphibolite. Slopes are densely forested with *Picea mariana*, *P. glauca*, *Abies balsamea*, and *Betula papyrifera* up to about 1100 m alt. Brook ravine below top escarpment harbours several northern plants mentioned on p. 124. — Photo Olof Rune 12.8. 1951.

Lower: Close-up of the tundra-like serpentine table-land of Mt. Albert, showing signs of an intensive frost action. Typical station of arctic-alpine plants, e.g., *Carex scirpoidea*, *Arenaria humifusa*, *Minuartia marcescens*, *M. rubella*, *Viscaria alpina*, *Rhododendron lapponicum*, *Artemisia borealis*. — Photo Olof Rune 12.8. 1951.

Plate II.

Upper: Limestone cliffs of Cap Bon Ami. Crevices of vertical rocks and limestone shingle at the base harbour a great number of rare plants, e.g., *Erigeron compositus*, *Arnica chionopappa*, *Dryas drummondii*, *Erysimum coarctatum*, *Solidago multiradiata*. In the foreground, *Picea glauca*. — Photo Olof Rune 19.8. 1951.

Middle: Mont St. Pierre with its extensive scree areas steeps abruptly towards the St. Lawrence. These and adjacent scree areas are the only stations of *Astragalus scrupulicola* and *Oxytropis gaspensis*. Highway Route 6 runs along narrow shore strip at base of scree areas. — Postcard photograph.

Lower: Sloping fen in the subalpine belt of Mont Auclair in the Table Top area, one of the classical localities of rare plants in Gaspé, presenting, e.g., *Carex macloviana*, *Agoseris aurantiaca*, *Senecio pauciflorus*, *Arnica lanceolata*, *Festuca scabrella*. But for the first plant, all belong to the Cordillera group. Surrounding forests consist of *Picea glauca* and *mariana*. — Photo Olof Rune 8.8. 1951.

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HEDERASTUDIER I NORRA HALLAND.

av

HJALMAR WIJK.

Från mitten av 1920-talet har jag fört anteckningar över påträffade förekomster av *Hedera* i norra Halland och södra delen av Göteborgs och Bohus län. Anteckningarna, till en början sporadiska, ha efter hand blivit mera regelbundna och slutligen så gott som årligen återkommande — detta sedan de hårda vintrarna i början och mitten av 1940-talet givit anledning till ett närmare studium av klimatets inverkan på hederabeståndet. Det är också närmast ur denna synpunkt de anteckningar jag här framlägger möjligen kunna vara av något intresse.

Till grund för den följande redogörelsen ligger materialet från de tre nordligaste hallandssocknarna Släp, Vallda och Onsala. Materialet omfattar sammanlagt 180 lokaler, alla belägna inom tre kilometer från närmaste havsstrand och således av utpräglad västkustkaraktär. Förekomsterna äro i övrigt av mycket växlande art, somliga starkt exponerade på steniga stränder eller öppna bergytor och rasbranter, andra väl skyddade, exempelvis i täta ensnår, andra åter belägna på torr eller fuktig skogsmark. Det stora antalet lokaler förklaras därav att som sådana redovisats inte endast väl slutna, inbördes vitt åtskilda ståndorter, utan även små, ofta obetydliga och varandra närliggande förekomster inom ett hederarikt område, vilka i vissa fall kunna anses vara rester av en ursprungligen större, sedermera splittrad enhet. Fullt konsekvent har denna uppdelning ej kunnat genomföras. Den torde dock i stort sett tjäna sitt syfte att skapa en bredare bas och därmed ett tillförlitligare underlag för de iakttagelser som avsetts.

Under den tid som observationerna fortgått ha i västra Sverige förekommit två särskilt hårda vintrar: 1942 och 1947. De meteorologiska uppgifter jag i det följande lämnar äro hämtade från sta-

tionen i Göteborg men torde i stort äga giltighet även för norra Hallands kustland.

År 1942 inföll under dagarna 20 januari–1 februari en period av ovanligt stark köld. Under dessa 13 dagar var den uppmätta maximitemperaturen —8,2°, minimitemperaturen —26° och medeltalet av de dagliga minima —18,4°. Samtidigt rådde, ovanligt nog vid så låg temperatur, en ihållande blåst, som vid själva minimum av —26° uppgick till 5 Beaufort. Vindriktningen var till över 90 % nord–ost och således relativt gynnsam för hederalokalerna, vilkas orientering genomgående är syd- och västlig; men uppenbart är dock att blåsten i hög grad skärpt den redan genom frosten hårda påfrestningen.

De skador som vållades i januari 1942 voro allmänna och i många fall mycket stora. Före denna tidpunkt hade 60 lokaler antecknats, och ingen av dem hade dittills fallit bort. Efter 1942 års frostvinter ha av dessa 60 förekomster 11 st. utgått: 1942: 1, 43: 2, 44: 1, 47: 3, 48: 2, 51: 1, 52: 1 — samtliga, även de sista, märkta av frosten 1942.

Den påföljande sommaren antecknades nio nya lokaler. Av dessa ha tre sedermera bortfallit: 1943 två och 1948 en, de två första på grund av skador från vintern 1942.

Den andra hårda frostperioden inföll under januari–mars 1947, då under 50 dagar i sträck termometern endast en gång översteg 0°. Kölden kulminerade mellan 5 februari och 3 mars, då medeltalet av de dagliga minima uppgick till —15,7° med en lägsta temperatur av —20,6°. Samtidigt var snöskyddet dåligt på grund av osedvanligt svag nederbörd: under en period av $1\,^1/_2$ månad, 17/1–28/2, uppgick den till sammanlagt 2,9 mm.

Frosten gick denna gång särskilt hårt åt de förekomster, där murgrönan på vattensjuk mark låg infrusen i is under flera månader. Av de nya lokaler som antecknades 1943/47, sammanlagt 83 st., hade flera ett dylikt läge. Avgången blev därför omedelbart mycket stor: 1947: 10, 48: 1, 49: 1, 51: 1.

Under åren 1948/53 ha antecknats 28 nya lokaler, av vilka två, båda mycket svaga, gått bort 1953.

De senaste årens milda vintrar ha varit mycket gynnsamma för murgrönan, som på många platser visat kraftig tillväxt.

Att dra några statistiska slutsatser av det här meddelade materialet är givetvis uteslutet — därtill skulle bl. a. krävas en mångdubbelt längre observationstid. Vad som däremot tydligt framträder är den allvarliga skada som vållats av de redovisade två frostvintrarna.

Fig. 1. På kartan ha markerats de i förteckningen upptagna 40 huvudlokalerna, ävensåa ett antal andra, där utrymmet så medgivit. Helt utgångna huvudlokaler ha utmärkts med öppna ringar, andra förekomster med fyllda dylika.

Dessa ha visserligen varit ovanligt hårda, och särskilt den första, med blåst och stark köld i förening, torde i sitt slag vara sällsynt. Rätt hårda vintrar av mer normal typ förekomma dock i västra Sverige med icke alltför långa mellanrum och kräva säkerligen även de sin tribut.

Det ligger nära till hands att fråga sig om de förluster som sålunda förorsakas av klimatet kompenseras med en motsvarande naturlig förnyelse av hederabeståndet. Ifall man då å ena sidan besinnar att överhuvud taget endast välbelägna och särskilt livskraftiga individ sätta frukt, att detta även under gynnsamma förhållanden sker långt ifrån varje år och att utsikterna för fröna att ge upphov till nya plantor äro ganska små, och om man mot detta väger den avgång som en hård vinter bevisligen kan medföra, så är det svårt att undgå den slutsatsen att murgrönan i västra Sverige befinner sig på tillbakagång och att beståndet under ett icke alltför avlägset tidigare skede varit väsentligt större än nu.

I detta sammanhang kan det vara av intresse att beröra en annan faktor, som otvetydigt och i stigande omfattning medverkar till att minska hederabeståndet: ingreppen från människans sida.

Under den period som här berörts ha på grund av husbygge, avverkning, militärarbeten under beredskapsåren, brand vållad av vårdslöshet med eld, samt genom direkt åverkan ett stort antal av de behandlade lokalerna blivit mer eller mindre skadade, och 12 st. ha helt och hållet förstörts — de flesta under de senaste åren offer för den snabbt ökade spridningen av stadsbefolkningens sommarbyggen.

I det följande lämnas en kortfattad översikt av det behandlade materialet. Därvid är att märka att vissa uppgifter ej äro fullständiga, så t. ex. beträffande blomning samt fyndår för vissa tidigare fynd. Måttuppgifterna ange högsta utsträckning i två mot varandra vinkelräta riktningar och avse åren 1952/53. Siffran inom parentes anger fyndåret, när detta antecknats.

Släp socken.

Örsviken. 3 lokaler på norra dalsidan vid gränsen till Askim.

1) högt på bergvägg mot SV nära avtagsvägen till Billdal (40). Död senast 44.
2) västligare, nära innersta delen av norra viken, under bergvägg mot S i skyddat läge på stora stenblock (41), 10 × 7 m.

3) ännu västligare, vid stranden bakom badhytter i brant ravin mot SV (41), nu kvar endast i övre delen.

Kyviken. I högt läge på berget Ö om Korshamn tre närbelägna lokaler.
1) spridd i skrevor och på bergvägg (40). Slutligt död 51.
2) på bergvägg högre upp (40). Död 47.
3) på bergvägg V om föregående (42). Död 43.

Skalvik (45). På norra sidan av viken nära stranden mot SV, skyddad i tätt ensnår, 4 × 11 m.

Budskär (46). Vid gångstig från hållplatsen västerut. Utgången på ursprungliga lokalen, men därifrån spridd ca 20 m längs stigen.

Skörvalla. 5 lok., därav 1–3 (47) på den villabebyggda höjden N om viken.
1) möjligen ej ursprunglig, på mark och bergvägg S om uppkörsvägen till villan, blommat 53.
2) på stenig sluttning S om villan, 4 × 8 m.
3) i skyddat läge strax V om villan, 4 × 7 m.

S om Skörvallaviken:
4) på sluttning åt SV och NV nedanför Wijkagården, numera under bergtall, delvis rik och klättrande, på 10 × 28 resp. 11 × 8 m.
5) på granntomten, NV om föregående, enstaka reva (50).

Särö. 3 lok. och grupper.
1) på sydsidan nära stranden (P. O. Westerbergs tomt) revor på bergvägg.
2) i Västerskogs sydvästra del nära Snäckstrand på delvis fuktig mark under ek, al, tall och idegran ett område med fem väl skilda mindre bestånd (45/48), det största 4 × 8 m. Två döda 47.
3) vid nordvästliga randen av Halsen, mitt emot föreg., klättrande och på mark under tall och vildapel, ett område med sju närbelägna, nu delvis sammanväxande bestånd (44/48). Ett dött 45.

En av äldre Säröbor omnämnd stor murgröna i Nordanskog har ej kunnat återfinnas. —

På fastlandet närmast Ö om Särö sträcker sig ett höjdområde, som på västsidan mellan Algusered och Klev är mycket rikt på murgröna. Hit höra följande fyra huvudlokaler:

Nötegång (40). N om vägen där denna korsar Skörvallaån, på bergvägg, träd och mark, 6 × 4 m.

Algusereds gård (46). Troligen ursprunglig, på bergvägg invid trädgården och på ovanför liggande mark. Numera blott vid bergfoten.

Algusered (46/53). Ett stycke S om föregående längs foten av höjdområdet på en sträcka av ca 300 m ett område med 28 särskilda bestånd av växlande storlek och art, somliga obetydliga, det största 16 × 9 m. Längs bergfoten övervägande ek och hassel, i SV ett fuktigt område med al. På grund av hård avverkning och partiell bebyggelse har områdets allmänna karaktär efter hand starkt förändrats. Av bestånden bortgick 47 åtta st. (därav sju i allunden); ett utgick 49.

Harnabacka (46/49). Längre söderut, på västsidan av samma höjdområde, klättrande och på mark under planterad tall, 6 lokaler, därav 4 mera betydande; den största, om 4 × 8 m, mycket rik.

Fig. 2. Murgröna i skogsmark under en gran. Halland, Släp s:n, Släps kyrkby, lok. nr 4. — Foto 21. 7. 1953.

Skild från detta höjdområde ligger förekomsten vid
Klevs allmänning (46/52). Längs bergfoten N om allmänningen på mark under planterad tall ett hederarikt område med 20 särskilda smålokaler, delvis nära varandra och obetydliga.

Ö om landsvägen Göteborg–Kungsbacka sträcker sig ett höjdområde som längs sin västra och södra rand och i ett inre parti är mycket rikt på murgröna. Hit höra följande återstående lokaler i Släp socken:

Stora Sannå. 3 lok.

1) N om gården under bergvägg nära åkern (42). Död efter trädfällning 47.
2) bakom gården i fuktig terräng under bergvägg (42). Död 48.
3) i bäckdal S om gården (43), klättrande och på mark under al, 7 × 15 m. Längre ner i dalen två mindre förekomster.

Lilla Sannå gård. 2 lok.

1) invid trädgården mot S starka stammar på bergvägg och därifrån spridd på marken ca 50 m längs bergfoten. Ofta blommande.
2) på bergplatån strax Ö om gården mindre förekomst under al (49).

Lilla Sannå (42/52). I randen av bergpartiet Ö om gården ett hederarikt område av ett par hundra meters längd med 27 särskilda förekomster av skiftande storlek och läge, alltifrån bergvägg till fuktig mark, de flesta hårt reducerade genom frosten och en samtidig avverkning som väsentligt förändrat områdets karaktär. En död 48, två 53, alla mycket svaga.

Släps kyrkby. 9 lok., därav

1–3) av likartad karaktär på träd och mark i skogen SO om kyrkbyn

under tall, björk och en (42), alla väl åtskilda och av betydlig storlek: 17 × 7, 17 × 8 och 16 × 10 m resp.

De övriga sex, alla betydande och säregna, i och omkring en östlig och en nordlig dalgång Ö om gården Kyrkbyn nr 3.

4) längst upp i norra dalen på bergvägg, stora stenblock och mark under gran och en (35), 13 × 15 m, högsta rankan på berget 5 à 6 m.
5) mycket högt på dalens östra bergvägg, i och ovanför rasbrant (35), ca 20 × 8 m; tidvis blommande.
6) i övre delen av östra bäckdalen, tidigare ymnig och klättrande, sedermera reducerad genom avverkning, ca 20 × 4 m.
7) i norra bergsidan ovanför föregående, på bergvägg och slät mark under en (40), 10 × 7 m.
8) längre upp och västligare, på slät mark under en, 6 × 12 m.
9) ovanför föregående i högt läge på bergvägg, stenblock och mark under ek och en, 17 × 12 m; tidigare blommande.

Prästbron (42). N om avtagsvägen till Tölö, på berghäll och sluttande mark under ek, en och hassel, 19 × 7 m.

På södra sidan av Kyrkbyns höjdområde ligga:

Kulekärr (34). N om gården, tidigare på bergvägg, nu blott på marken några revor.

Brogrens kvarn. 6 lok., därav

1–3) längs bergväggen V om kvarnen, de två västligaste om 5 × 4 resp. 9 × 3 m, kraftiga på berghäll och mark; den östligaste, nära kvarnen, uppdelad i fyra mindre förekomster på bergvägg i olika nivåer och vid bergfoten. Två döda 48.

Högt uppe i berget ovanför kvarnen ligga:

4) nära skogsranden på klippblock, mark och berghäll (46), 4 × 5 m.
5) längre in under en, hassel, apel och ask, på mark 15 × 3 m, och på berghäll (49).

S om kvarnen ligger

6) på bergvägg invid gård; enligt uppgift ursprunglig.

Vallda socken.

Klackartorpet (35). Nedanför berget N om stugan, på klippblock och stenig mark under ek och hassel, 6 × 5 m.

Rörvik (30). I högt och öppet läge på södra sidan av Nötaberget på och numera blott nedanför vertikal bergvägg mot SV.

Vallda Sandö (31/40). 6 lok.

1) mot S på stenig, delvis snårbevuxen backe V om stugan vid norra hamnen, spridda rester av ursprungligen stort område.
2) på östra sidan av norra viken, gammal stam på berg, 1 dm i omkrets, och vitt spridd på stenig mark nedanför; tidigare blommande. Död 48.
3) på östra sidan av västra viken, på och nedanför bergvägg mot S.
4) V om västra hamnen, svag förekomst på småstenig mark. Död 42.
5) på sydsidan NO om Knapen, på blockmark bland krypande dvärgalm. Död 47.
6) vid stranden V om Knapen, spridda rester på stenig mark mot S.

Fig. 3. Murgröna klättrande på bergvägg. Halland, Vallda s:n, Vallda-Sandövägen, lok. nr 2. — Foto 18.4. 1948.

Vallda-Sandövägen. 2 lok.

1) ett stycke Ö om avtagsvägen till Tolvsbo, N om landsvägen och längs denna på rasbrant, bergvägg och slät mark under lövträd, hassel och en (35), 28 × 13 m.
2) något längre västerut bakom ett änge N om vägen (46). Ursprungligen mycket utbredd och rik på bergvägg, rasbrant och slät mark. Nu kvarlevande på bergväggen med kraftig stam. Tidvis blommande.

Lunnakulla (37). Ö om gården i västligt läge på blockmark under planterad tall, 6 × 4 m.

Vipekärr (33/34). 2 lok. strax Ö om vägen till Skiftekärr.

1) N om tallskogen, på stenblock och mark på och invid sedermera bebyggd tomt.
2) sydligare, ett stycke in i skogen, på och längs bergvägg, 6 × 3 m.

Rörmöst (37). Ca 600 m SSO om gården, nära västra ändan av en större tjärn, i dalsänka på stenig mark och på bergvägg mot N under planterad, nu delvis avverkad tall, 14 × 10 m.

Småkulla (41). I berget ca $^1/_2$ km Ö om gården, i smal klyfta mot V. Utplånad av brand 53.

Nellevik (39). I dalsänka mot havet SV om gården, ej långt från stranden, mot SV. Täckte tidigare helt stenig strandvall; en frisk reva kvarlever.

Lerkil (39/40). 3 lok. i berget längs stranden SV om Lerkilsviken.

1) i klyfta S om sänka i bergryggen. Skadad av brand 47.
2) sydligare, på bergväggen mot V. Dödad av branden 47.
3) ännu sydligare, där bergryggen slutar. Svag förekomst på ljungmark. Död 43.

Hästakärr. 6 lok.

1) på bergvägg innanför Hamnaholmen (40). Död 43.
2) sydligare, liten förekomst i ljungmark (42). Död 43.
3) vid den mot S vettande stranden Ö om Stensholmen, innanför en liten tjärn på sten under slån och örter (39), 14 × 7 m.
4) strax ovanför båthamnen (38), och
5) på gammal strandvall S om denna (39), båda förstörda av militärarbeten under beredskapstiden.
6) ovanför båthamnen, Ö om en därifrån ledande stig, under ensnår (51), 1 × 1$^1/_2$ m.

Från inre delen av Vallda socken ha följande lok. antecknats:

Ysby. 2 lok.

1) NO om gården i dalsluttning mot NV under lövträd och tall (43), klättrande och på marken, 21 × 10 m.
2) i sluttningen Ö om gården nära vägen till Kungsbacka, under tall (52), rik, 8 × 12 m.

Vrå. 2 lok.

1) i sydvästra delen av tallskogen N om vägen till Kollahed, på träd, sten och mark (45), 6 × 7 m.
2) längre österut, på sydlig bergsluttning N om vägen, bland sten och snår (41), 4 × 1 m.

Kroken (41). 3 lok.

1) ca $^3/_4$ km S om föregående, ungefär halvvägs mellan Lunden och Kallareberget på bred öppen stensluttning mot SV; ursprungligen mycket rik, 16 × 10 m.
2) ca 100 m sydligare på berghäll och mark under al och en, 10 × 6 m.
3) östligare, N om stigen som leder till Kallareberget, i två grupper om 4 × 1 m på backsluttning under buskvegetation.

Fig. 4. Murgröna på öppen stenig strandvall. Halland, Onsala s:n, Västra Hagen, lok. nr 1. — Foto 22.8. 1940.

Maa (41). 2 lok.

1) OSO om gården bakom planterad barrskog nedanför bergsluttning på stenig mark mot SV, 19 × 14 m.
2) ca 300 m SO om föregående i högt läge på sydostsidan av samma bergområde alldeles intill onsalagränsen, på bergvägg och sten under ek, spridda revor.

Kallareberget (45). I högt läge mot SV i storstenig bergskreva, 7 × 9 m.

Onsala socken.

Västra Hagen (40). 4 lok.

1) på öppen stenig strandvall mitt emot Onsala Sandö, tidigare rikt täckande, 24 × 4 m.

De övriga tre lokalerna på klippblock och stenig mark i skogsranden Ö om gården Västra Hagen nr 1 under ek, asp och hassel.

2) nordligast, 17 × 18 m.
3) ca 75 m S om föregående, 14 × 28 m.
4) sydostligare och högre upp, 14 × 28 m.

Fjärehals. 3 lok.

1) i nordöstra hörnet av viken N om halsen, tidigare täckande öppen stenig strandvall (38), 13 × 5 m; blommande 48, 50, 52/53.
2) på sydsidan av halsen mitt emot Chalmers observatorium, i storstenig terräng (38), delvis rik, 14 × 8 m; blommande 50, 52/53.
3) västligare i samma terräng (43), delvis rik, 11 × 7 m.

Fig. 5. Murgröna överväxande block. Halland, Onsala s:n, Fjärehals, lok. nr 3. — Foto 30.7. 1953.

Orrviken (37). Nära stranden, något N om viken, i storstenig dalsänka, 9 × 1 m. Gick tidigare ända ned i strandens *Crambe*.

Mönster (36). Invid gångstig som i N övertvärar halvön, på öppen bergsida och blockmark; ursprungligen mycket rik. Utsträckning 28 m.

Knastås (39). Ursprungligen betydande förekomst i utsatt högt läge på sydsidan av berget mellan Knastås och Mönster. Död 47.

Hultet (39). I bred bergskreva mot S på höjdområdet Ö om gården, 5 × 3 m.

FURTHER CONTRIBUTIONS TO THE GENUS OSTEOSPERMUM.

BY

TYCHO NORLINDH.

It is my hope that I shall soon have an opportunity of revisiting South Africa and completing my investigations there; and it is my intention to publish thereafter a comprehensive supplement to my 1943 monograph on the genera in the tribe *Calenduleae*. The present paper is merely a fragment of a large manuscript on *Osteospermum* which is not yet ready for the press and which is based on the material that I was able to borrow from the herbaria in South and East Africa, England and Portugal after the war.

I beg to tender my sincerest thanks to the Directors and Curators of the herbaria and museums from which I have received specimens on loan. When quoting specimens, I have indicated in brackets the herbarium in which they are to be found. Herbarium abbreviations are given according to Lanjouw and Stafleu, Index Herbariorum I, ed. 2 (1954), pp. 131–144.

Osteospermum angolense T. Norl. spec. nova.

Icon.: Fig. nostrae 1 *a–e*, 2.

Typus speciei: Gossweiler n. 10816 in herb. Coimb.

Herba verisimiliter perennis usque 1 m alta; caulis erectus inferne lignescens simplex usque 5 mm crassus medio simplex vel parum ramosus corymbo terminatus ramis lateralibus corymbiferis ± superatus; caulis et rami teretes striati breviter glanduloso-pilosi, pilis pluricellularibus; internodia usque 7 cm longa. Folia rigide membranacea brevissime glanduloso-pilosa (exsiccata aspera) opposita vel superiora alterna; folia inferiora et media petiolata, petiolis usque 1,5 cm longis, lamina ovata–elliptica usque 7 cm longa usque 4,5 cm lata basi breviter cuneata apice obtusa vel rotundata leviter mucronata margine sinuato-dentata, dentibus mucronatis, vel remote denticulata; folia superiora caulis et folia ramorum anguste elliptica–lanceolata breviter petiolata vel sessilia margine remote dentata–

denticulata; nervus medius crassus elevatus albidus, nervi secundarii (foliis superioribus exceptis) 2–5 anastomosantes conspicui. Inflorescentiae in apice caulis et ramorum corymbosae vulgo 3–5-capitulatae, capitulis fructiferis nutantibus pedicellis 2–7 cm longis instructis; rami inflorescentiae brevissime et dense glanduloso-pilosi (exsiccati asperi) bracteis paucis lineari-subulatis 4–10 mm longis instructi. Involucri squamae c. 10 univel subuniseriatae aequilongae lanceolatae c. 4 mm longae et 1,5–2 mm latae acutae dorso glanduloso-puberulae margine late albido-scariosae serrulato-ciliatae. Flores radii involucri squamas numero aequantes: ligulae flavae involucrum plus duplo superantes; flores disci numerosi flavi. Achaenia dimorpha; plurima trialata, pauca exalata (haec interdum desunt); achaenia alata, alis rigidis semipellucidis pallide stramineis plerumque partim violaceis 2–2,5 mm latis, sat magna (alis exceptis) 9–11 mm longa apice cavernulam includentia trifenestrata, fenestris subrotundis c. 1 mm diam., triangularia, lateribus parce glanduloso-pilosis ± rugosis sulco longitudinali e basi ad medium latus pertinenti instructis; achaenia exalata teretia parce glanduloso-pilosa c. 13 mm longa basi stipitata apice tritubercula.

Angola: Huila, Quilemba, Exell et Mendonça, 1937, n. 2530 (COI). — Huila, Quilemba, Serra da Chela, 1900 m s. m., Gossweiler, 1937, n. 10816 (COI).

Osteospermum angolense occupies morphologically an intermediate position between *O. connatum* DC. and *O. monocephalum* (O. et H.) T. Norl. It has dimorphous achenes, winged and wingless, like *O. connatum*, but its winged achenes are about twice as large as those in the latter species. In contrast to *O. angolense* the lower and middle leaves of *O. connatum* are, in addition, ± broadly hastate-auriculate.

It differs from *O. monocephalum*, among other things, by having dimorphous achenes, a corymbose inflorescence and ± long-petioled lower and middle leaves.

From the phytogeographical point of view *O. angolense* is particularly interesting because it has only been met with in tropical territory, viz. in the Huila district of S. Angola. Previously only one species of this genus, *Osteospermum Volkensii* (Norlindh 1943, pp. 122, 406), which is phytogeographically so extremely isolated, was known exclusively from tropical Africa.

Osteospermum afromontanum T. Norl. spec. nova.

Icon.: Fig. nostrae 1 f, 2.

Typus speciei: Greenway n. 7665 in herb. Afric. Orient., Nairobi.

Frutex vel suffrutex usque 1,3 m altus parum ramosus; rami erecto-patentes–divaricati teretes rigidi partibus vetustioribus valde lignescentes sat dense cicatricosi cortice griseo–fusco sparse piloso vel subglabro obtecti

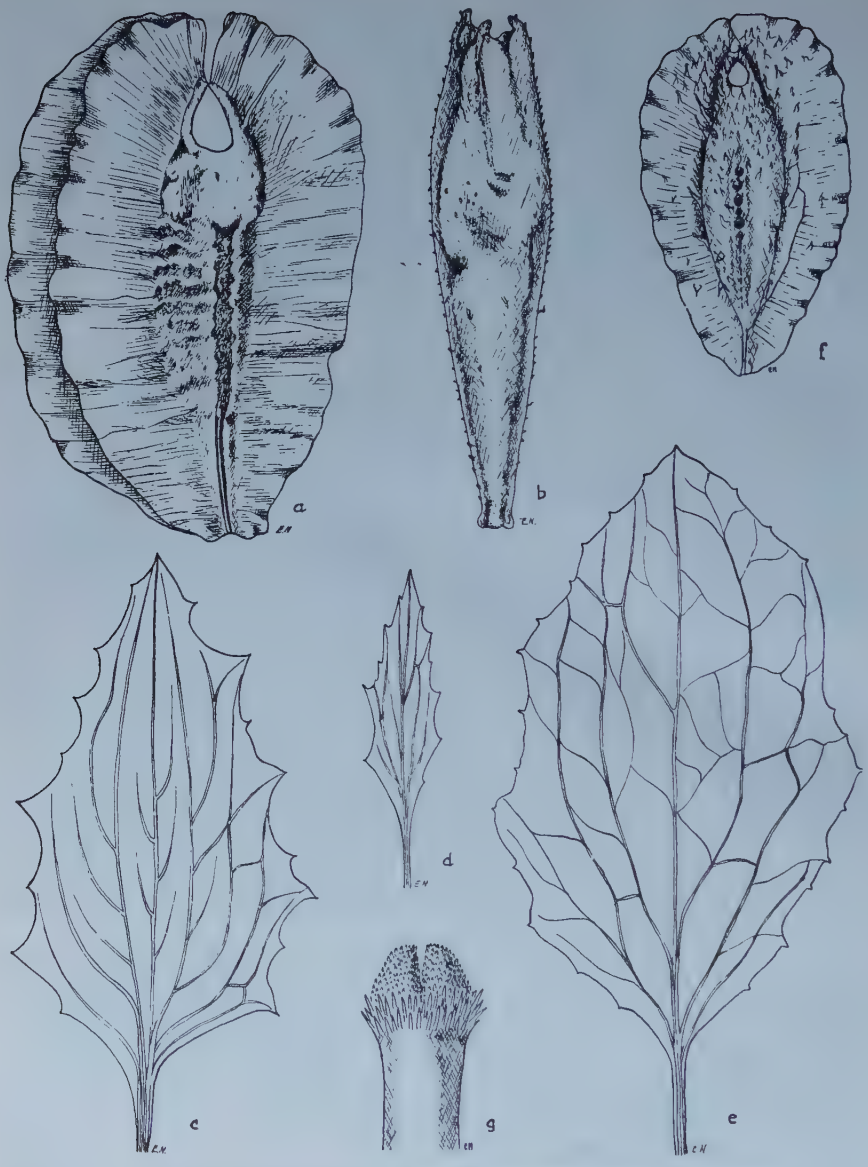

Fig. 1. *a e*, *Osteospermum angolense* T. Norl. *a*, 3-winged achene; *b*, *wingless*, almost terete achene; *c* lower, *d* upper, and *e* medial cauline leaf (*a*, *b*, *e*, Gossweiler n. 10816; *c*, *d*, Exell et Mendonça n. 2530 in herb Coimbr.). — *f*, *Osteospermum afromontanum* T. Norl., 3-winged achene (*f*, Greenway n. 7665 in herb. Afr. Orient., Nairobi). — *g*, *Osteospermum acutifolium* (J. Hutch.) T. Norl., uppermost part of the sterile disc style. (Before the drawing was made, the lobes were forced apart a little to show their length.) Stigmatic papillae absent, collar of pollen-sweeping hairs a little below the point of bifurcation (Stephens n. 6952 in herb. Bolus.). — *a*, *b*, *f*, × 5; *c–e*, × 1; *g*, × 20. (Mrs. E. Nordström delin.)

partibus junioribus subherbacei virides pubescentes dense foliati. Folia alterna brevissime glanduloso-pilosa oblanceolata–anguste elliptica–lanceolata vel lineari-oblonga apice mucronulata rotundata–obtusa vel rarius acuta basin versus in petiolum angustata vel sessilia petiolo incluso usque 5 cm longa usque 1,5 cm lata margine remote denticulata vel rarius sinuato-dentata, dentibus utrinque 1–4, vel rarissime subintegerrima; nervus medius crassus subtus elevatus, nervi secundarii vix conspicui. Capitula in apice ramorum solitaria vel pauca (2–3), fructifera nutantia; pedunculi capitulorum breviter et dense glanduloso-pilosi 2–7 cm longi nudi vel saepius bracteis paucis linearibus vel lineari-lanceolatis instructi. Involucri squamae 8–14 uniseriatae fere aequilongae lineari-lanceolatae 5–7 mm longae 1–1,5 mm latae dorso brevissime glanduloso-pilosae margine serrulato-ciliatae anguste vel inconspicue albido-scariosae. Ligulae florum radii flavae involucrum duplo superantes; corollae florum disci flavae. Achaenia fere 9 mm longa apicem versus glanduloso-papillosa trialata, alis semipellucidis usque 2 mm latis; cavernula apicalis trifenestrata, fenestris vix conspicuis.

Tanganyika Terr.: Hanang Mtn, Mbulu distr., c. 3300 m s. m., Burtt, 1932, flor. et fruct. 2 Sept., n. 4030 (K). — Mt. Hanang, N.E. slope, S. Mbulu distr., c. 3300 m s. m., Greenway, 1946, flor. et fruct. 8 Febr., n. 7665 (EA, K, PRE).

O. afromontanum is morphologically closely allied to the polymorphous and widely distributed species *O. Vaillantii*. In contrast to *O. Vaillantii* the stem and branches become strongly lignified in *O. afromontanum* so that it develops into a shrub or undershrub, which may be as much as 1.3 m high. It further differs from *O. Vaillantii*, inter alia, by the leaves being densely disposed, often rosulate in the apices of the branches, by the branches being rather densely provided with leaf-scars or with remaining portions of fallen leaves, and by the apical cavity of the achenes being small and inconspicuous. The achenes, especially near their apices, bear glandiferous papillae, which partially conceal the fenestrae of the apical cavity.

Hitherto *O. afromontanum* is only known from two collections from Mt. Hanang in tropical East Africa (see Fig. 2), viz. Burtt n. 4030 and Greenway n. 7665. The species has been found at an altitude of 10,000 ft (*c.* 3300 m) on this mountain, which is situated immediately south of the southernmost known outpost of *O. Vaillantii*, Hohenlohe Rift Scarp at an altitude of 1800 m in the Mbulu district (Norlindh 1943, Map 54, p. 419).

O. afromontanum differs widely from the other *Osteospermum* species, *O. Volkensii*, which is also endemic to Tanganyika Territory

Fig. 2. Distribution of two tropical montane *Osteospermum* species, *O. angolense* T. Norl. (open circle) only known from mountains, *c.* 1900 m s.m., in the Huila district in Angola. *O. afromontanum* T. Norl. (filled circle) on Mt. Hanang in the Tanganyika Terr.

and which only occurs on Kilimanjaro. The latter has, in fact, wingless achenes without an apical cavity and thus belongs to the subgenus *Euosteospermum*.

Osteospermum acutifolium (J. Hutch.) T. Norl. comb. nova.

Syn.: *Dimorphotheca acutifolia* J. Hutch.: J. Hutchinson in Ann. S. Afr. Mus. IX (1917), p. 415. — *Calendula scabra* Berg.: P. J. Bergius, Descr. pl. Cap. (1767), p. 310. — *Dimorphotheca scabra* DC.: A. P. de Candolle, Prodr. Regn. Veg. VI (1837), p. 72. — *"Calendula Tragus"* Jacq. (non Ait.): N. J. Jacquin, Hort. Schoenbr. II (1797), p. 14. — *Dimorphotheca Tragus* DC.: A. P. de Candolle, l.c., p. 71. — *Osteospermum pulchrum*

T. Norl.: T. Norlindh, Studies in the Calenduleae I (1943), pp. 239–244, 413.

Icon.: N. J. Jacquin, l.c., tab. 153, sub nom. *Calendula Tragus.* — T. Norlindh, l.c., fig. 23 b et 24, sub nom. *Osteospermum pulchrum.* — Fig. nostra 1 *g*.

This species was described as early as 1767 by Bergius under the name of *Calendula scabra* and was transferred in 1837 to the genus *Dimorphotheca* by De Candolle. As it has ♀-sterile disc flowers with typical *Osteospermum* styles (see Fig. 1 g) I transferred it to the genus *Osteospermum* in 1943, but was then obliged to choose a new specific name for it, because Thunberg had already given the name of *Osteospermum scabrum* to an entirely different plant. I called it *Osteospermum pulchrum* without knowing that it was identical with *Dimorphotheca acutifolia* earlier described by Hutchinson.

When I published my monograph on the genera *Dimorphotheca*, *Castalis*, *Osteospermum*, etc., in 1943, I had had no opportunity of studying the type specimen of *Dimorphotheca acutifolia* and, owing to the war, it was then unfortunately impossible to loan any specimen of that species. According to Hutchinson, *Dimorphotheca acutifolia* is most closely allied to *D. aurantiaca* DC., which is identical with *Castalis Tragus* (Norlindh 1943 p. 82), and this I assumed to be correct. Later, when I was able to examine the specimens on which Hutchinson's description of *Dimorphotheca acutifolia* is founded, I discovered that they belong to the form series of *Osteospermum pulchrum*, even though they exhibit certain deviations in respect of the colour of the flower. In view of the fact that the specific epithet "*pulchrum*" was the later one of the two to be published, I have to make the new combination *Osteospermum acutifolium*.

According to Hutchinson the ray flowers of *Dimorphotheca acutifolia* are either yellow or white above ("supra flavi vel albi"). He had obtained this information about the colour of the flowers from the labels of the collectors. In his description of the species Hutchinson cites five collections of which the following are said to have ray flowers that are yellow above: Stephens nn. 6901, 6952 (typus auctoris), and 6957. In the remaining two collections, Stephens n. 6965 and Phillips n. 7434, the ray flowers are white above. When studying an abundant material of the species which I have earlier named *Osteospermum pulchrum* [syn. *Dimorphotheca scabra* (Berg.) DC.], I found no specimen whose ray flowers were yellow above. On the other hand, the ray flowers of this species were sometimes

ochraceous along the edge of the under-side, as I had observed during my field studies in the Cape. It is not entirely out of the question that STEPHENS' statement to the effect that the ray flowers are yellow above, is incorrect. For the present I am, however, assuming that *Osteospermum acutifolium* comprises two races in respect of the colour of the flowers. Of these the one whose ray flowers are yellow above, is likely to be extremely rare, and probably it is hitherto represented only in the three collections made by STEPHENS.

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Svensk Botanisk Tidskrift. Bd 48, H. 1. 1954.

ON THE FINE STRUCTURE OF THE OUTER PART OF THE SPORE WALL OF LYCOPODIUM CLAVATUM AS REVEALED BY THE ELECTRON MICROSCOPE.

BY

B. M. AFZELIUS, G. ERDTMAN, and F. S. SJÖSTRAND.

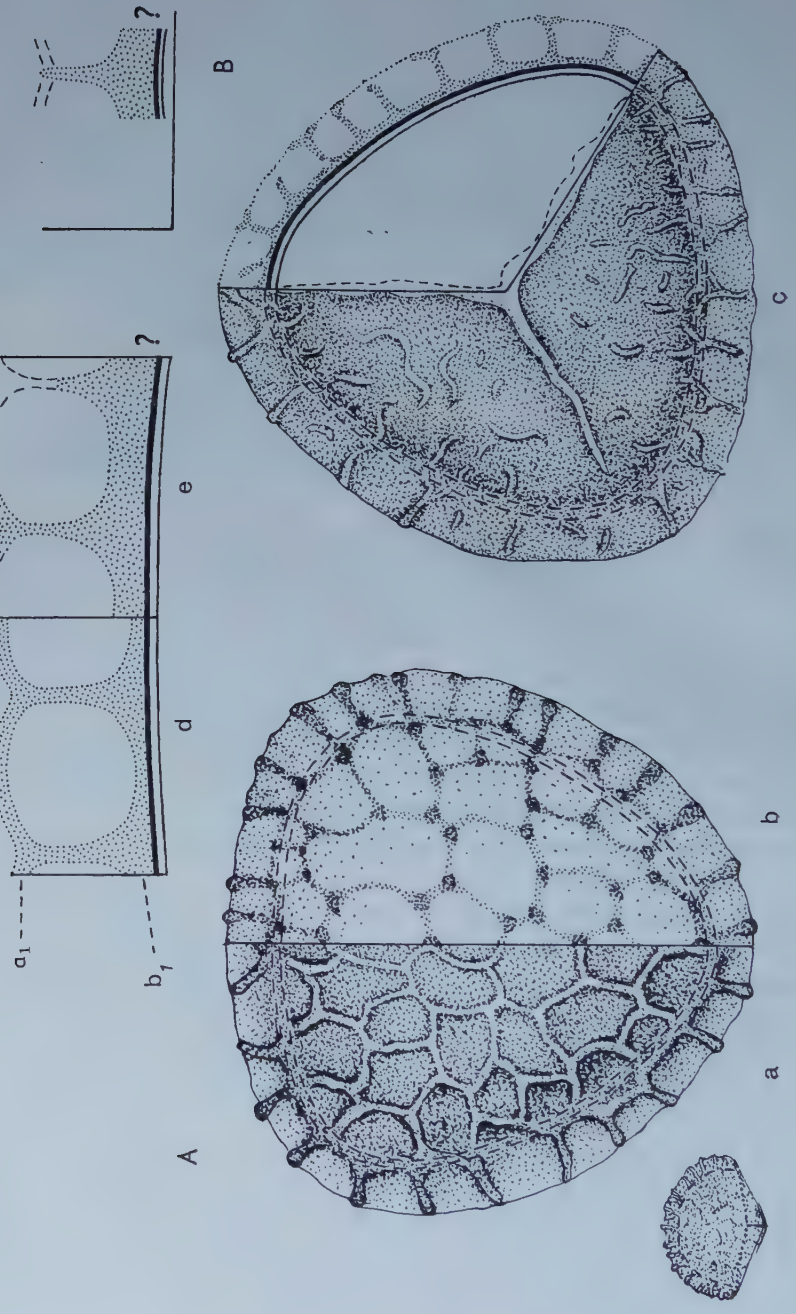
The characterization of pollen grains and spores is based primarily on the structure of the pollen and spore wall, the sporoderm. Some of the structures used in describing pollen grains and spores are frequently so small as to be at the limits of the resolving power of the light microscope. The use of electron microscopy in this field would be of great interest, e.g. in connection with a finer characterization of the different types of spores and pollen grains.

From a functional point of view, a better knowledge of the structure and chemistry of the sporoderm would increase our understanding of its function in protecting the protoplasm from the perilous effects of the milieu.

This paper is an account of some attempts to make use of the resolving power of the electron microscope on ultra-thin sections in order to reveal the fine exine structure of spores of *Lycopodium clavatum* and *Selaginella selaginoides* (megaspores).

Earlier attempts to apply electron microscopy to this problem have been made by Fernández-Morán and Dahl (1952) and by Mühlethaler (1953).

In these earlier investigations, the exine as well as the intine and the interior of the grain were dealt with. The sections were, however, too thick to reveal the fine structure. The exine layers observed by these authors can be seen with an ordinary light microscope (cf. e.g. the descriptions in Erdtman 1952). Mühlethaler assumes that all pollen exines are built on the same principle and that struc-


A
B
a
b
c
d
e
a1
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turally the walls are very little differentiated. This idea, however, has already been disproved by the earlier papers of Brorson-Christensen (1949) on microphotographs of microtome sections, and of Erdtman (l.c.) who made a large number of palynograms of pollen grains of dicotyledonous plants (see, for instance, the young pollen grains of *Cobaea penduliflora*, depicted on page 330).

Material and Methods.

Several types of pollen grains and spores were investigated. For many reasons chiefly spores of *Lycopodium* will be dealt with in the present paper. A picture of part of the megaspore wall of *Selaginella selaginoides* is added in order to give an idea of the great structural differences between the two.

The *Lycopodium* material consists of dry spores. In most of these the remains of the intine and the protoplasm were removed by heating the spores to 100° C. in a mixture of acetic anhydride (nine parts) and sulphuric acid (one part). After the acetolysis, the spores were bleached with chlorine. We have also tried the effect of different swelling agents (chromic acid and 0.5 per cent sodium hydroxide).

The spores were electron-stained with osmic acid, dehydrated in alcohol, and embedded in a mixture of *n*-buthyl and methyl-metacrylate (Newman, Borysko, and Swerdlow 1949).

The megaspores of *Selaginella selaginoides* were taken from material preserved in formaldehyde. The spores were acetolyzed and treated in the same way as the spores of *Lycopodium*.

The sections were made with the ultra-thin sectioning technique worked out by Sjöstrand (1951, 1953 b), using the microtome designed by him (1953 a) and a cutting edge of highly polished Schick razor blades. The sections were floated on a liquid surface (Gettner and Hillier 1950), using as liquid 20 per cent ethyl alcohol. They were transferred to grids covered by a thin formvar

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Fig. 1. A: Palynogram, *Lycopodium diaphanum* (Tristan da Cunha; Christophersen n. 2306); *a*+*b*: distal face (*a* at high, *b* at low adjustment of the microscope; the different foci correspond to levels a_1 and b_1 in Fig. A: *d*; *c*: proximal face (main part of figure: surface view at high adjustment; upper right hand part: section through the exine); *d* and *e*: outline of exine stratification (*d* at distal pole, *e* at the equator). — B. *Lycopodium clavatum*: detail corresponding to that in *L. diaphanum* shown in Fig. A: *e*. — ×2000 (A: *a*—*c*), ×4000 (A: *d* and *e*; B), ×500 (lower left hand detail figure: spore of *L. diaphanum* in equatorial view; distal face up).

film. The thinnest sections obtained were between 0.02 and 0.03 microns in thickness.

In some cases the metacrylate was dissolved in amyl acetate. The structure of the exines is sufficiently sturdy to resist the effect of the surface tension when evaporating the solvent.

Results.

Morphologically, the spores of *Lycopodium clavatum* are of the same type as those of *Lycopodium diaphanum* illustrated in Fig. 1. This figure shows the same morphological features as found in *Lycopodium clavatum* spores when examined in the light microscope (see legend).

Electron micrographs of acetolyzed spores of *Lycopodium clavatum* show that the exine is divided into two layers. The inner layer appears to be a fine granular mass with no sharp boundary towards the interior (Fig. 4). The outer layer has a characteristic fine structure of concentric lamellae (Figs. 3, 4). The surface area of the individual lamellae is considerably smaller than the general surface area of the wall. In cross-sections of the lamellae, therefore, the spaces between the different layers of the lamellae communicate with each other. Sometimes the lamellae seem to fork. This may perhaps be due to the densely packed lamellae not being completely separated by the treatment of the spores before sectioning. The thickness has been measured in areas where they were, presumably, cut at right angles to their surface. The values thus obtained are shown in Fig. 2, a diagram which presents a distribution of values in two main groups. One of these exhibits a maximum at about 130 Å, the other a less defined maximum at 260 Å. The first group also contains a noticeable number of values within the range 50—90 Å.

In spores treated with chromic acid, the swelling of the lamellae makes the exine appear homogeneous. This effect can clearly be seen in as short a time as five minutes after treatment. No appreciable changes in spores treated in this way can be seen with a light microscope. In spores treated with 0.5 per cent sodium hydroxide the lamellae swell and the interstices between them are obliterated.

The exine structure found in the megaspore wall of *Selaginella selaginoides* is of an entirely different type. The wall is here composed of a three-dimensional network of rounded bars (Fig. 5).

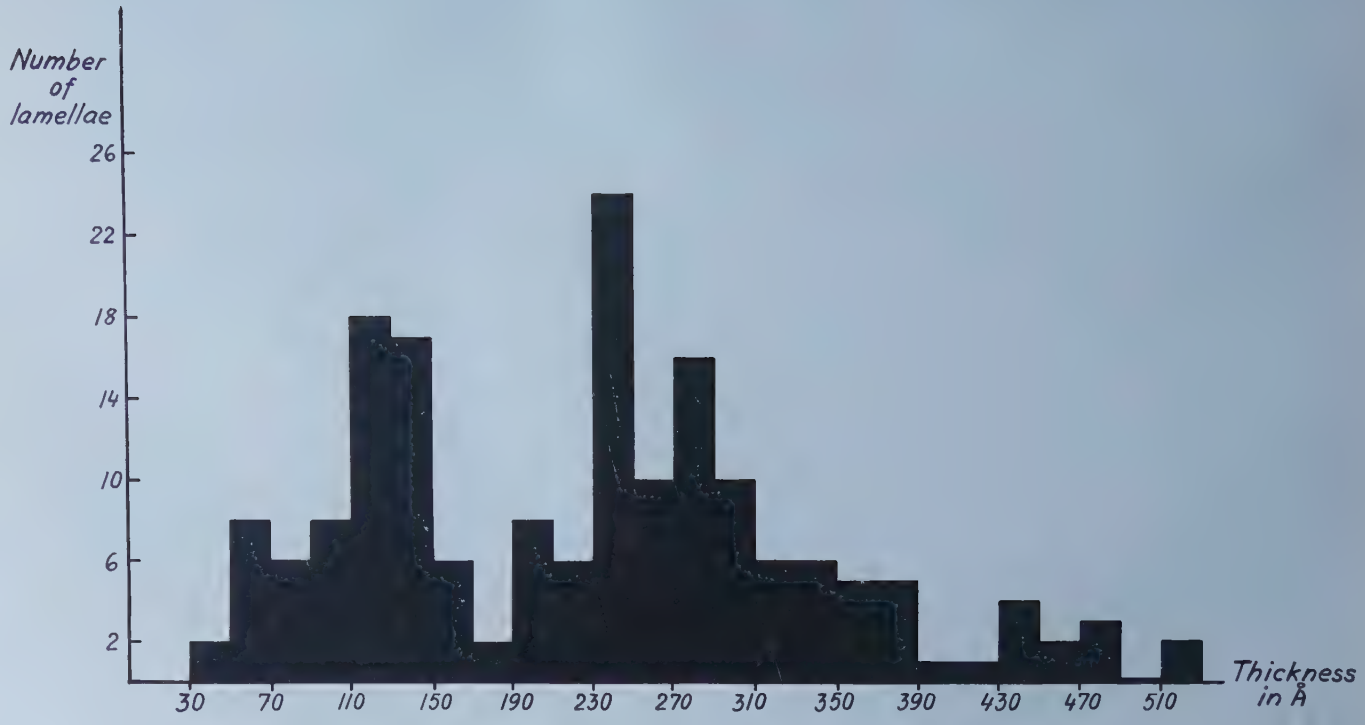


Fig. 2. Thickness of the lamellae.

Discussion.

The characteristic lamellated structure of the outer exine layer of the spores of *Lycopodium clavatum* represents dimensions far below the resolving power of the light microscope and has not been observed earlier. As the spore wall is remarkably resistent chemically, it seems justified to assume that this laminated structure, which has been observed also on non-acetolyzed material, is real and not produced by the treatment. This treatment has certainly helped to reveal the lamellae by increasing the interlamellar spaces and dissolving the electron-scattering material in these spaces.

The distribution of values of the thickness of the lamellae presented in Fig. 2 indicates that there may exist a unit lamella with a rather well-defined dimension, as far as thickness is concerned. Pronounced thickness variations would then be due to aggregations of unit lamellae.

The maximum at 130 Å may be used as a starting point when discussing the diagram from this point of view. The maximum at 260 Å shows that the main part of the lamellae of this group represents doublets of the 130 Å unit. The second group also exhibits an asymmetry with an over-representation of values at about 370 Å, close to the value for an assumed triplet.

The first group of values also shows an asymmetry with a noticeable number of values at about 60 Å. This asymmetry is due to the presence of a fairly thin elementary lamella, the 130 Å lamella thus being composed of two elementary lamellae of this kind. However, these thinnest lamellae have only been observed in the most peripheral part of the exine, and to be able to draw any conclusions in this direction it would seem to be necessary to trace these thin lamellae in the outer layer of the exine throughout.

The observations on non-acetolyzed osmium-fixed material seem to indicate that the lamellae and the material between them are of similar opacity to the electron beam. There appears to be no preferential staining by osmium tetroxide. It seems important to obtain high-resolution pictures of the spore wall from material that has not been subjected to acetolysis, and, secondly, to investigate to what extent laminated structure is present, in one form or another, in other pollen grains or spores. For such studies, new methods of electron staining should be sought for.

Sporopollenin, the chemical substance (or substances?) that has the remarkable property of being resistant to decay for geological

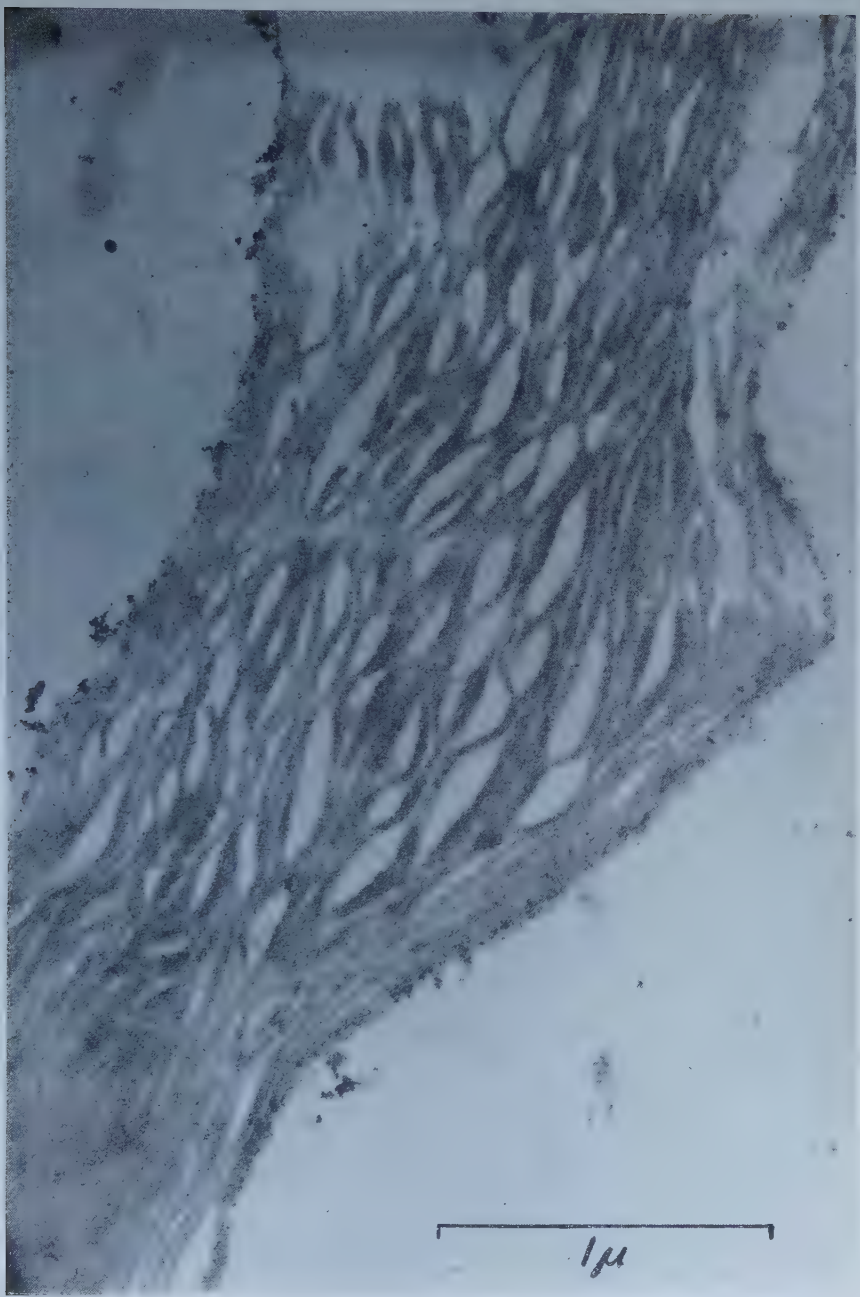
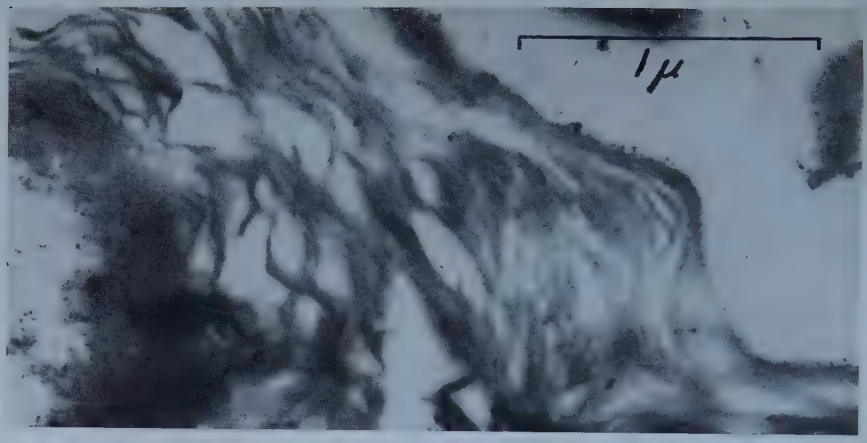


Fig. 3. Section through the exine in *Lycopodium clavatum*. (Metachrylate dissolved by amyl acetate.) ×45000.



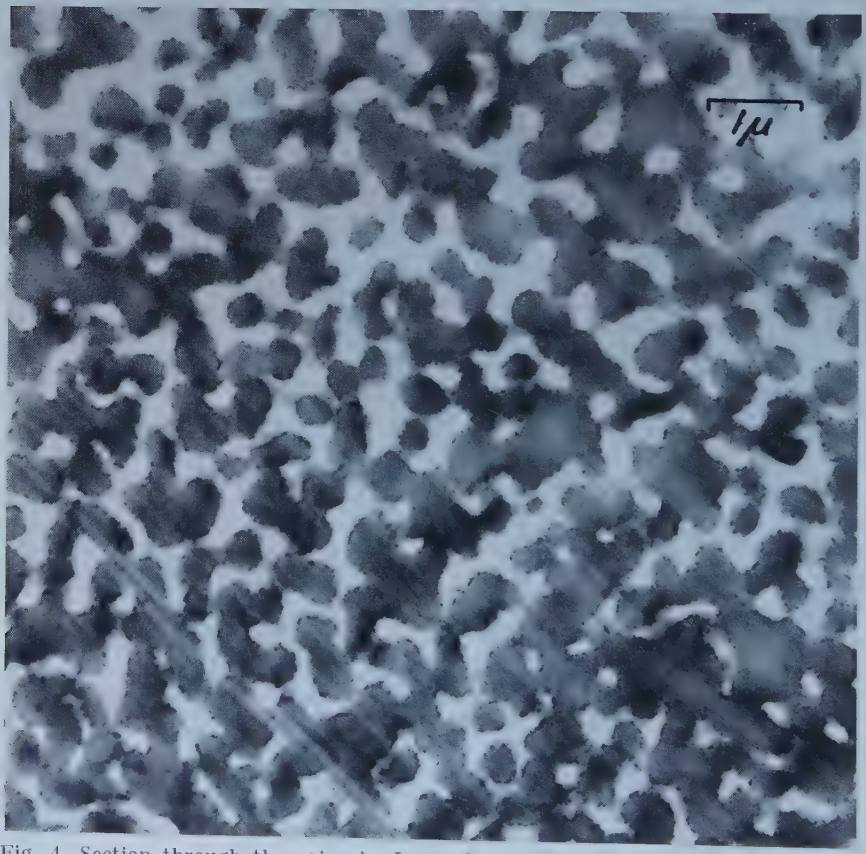


Fig. 4. Section through the exine in *Lycopodium clavatum*. An outer laminated and an inner granulated layer can be seen. ×40000.

Fig. 5. Section through part of the exine of a megaspore of *Selaginella selaginoides*. ×12500.

eras, is thought, for chemical and polarization-optical reasons, to be organized in a spatial network (Frey-Wyssling 1953). The observations presented here do not support this assumption as far as *Lycopodium clavatum* is concerned. During the present study, a laminated structure has also been observed in coniferous pollen grains.

Summary.

Electron micrographs (Figs. 3, 4) of acetolyzed spores of *Lycopodium clavatum* show that the exine is divided into two layers, the outer being laminated (lamellae concentric), the inner granulated. A unit lamella of 130 Å and aggregations of this unit lamella, usually doublets, have been found (Fig. 2).

An electron micrograph of the exine of the megaspore wall of *Selaginella selaginoides* is shown in Fig. 5.

Department of Anatomy, Karolinska Institutet, Stockholm, and Palynological Laboratory, Bromma (Stockholm), August 1953.

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THE DISTRIBUTION AND ECOLOGY OF FISSIDENS JULIANUS IN NORTHERN EUROPE.

BY

GUNNAR LOHAMMAR.

Fissidens julianus (Sav.) Schimp. has been considered as one of the rarest moss species of Northern Europe. Closer investigations have shown, however, that it grows in a considerable number of places. Its distribution seems to be unique and to be due to a fairly remarkable reason.

The moss was first discovered in Sweden by S. O. Lindberg who collected it in 1853 in Lake Söderbysjö southeast of Stockholm and two years later at the adjacent "Nacka bro". In 1857, 1870, 1884, and 1887 the moss was found in lakes in the provinces of Östergötland, Uppland, Småland, and Västergötland, but only in one lake in each province. Thus, in the course of 35 years it had been found in a total of 6 localities. More than 40 years elapsed before the next find was made, which happened in 1930 when I detected the plant in a lake in the province of Norrbotten. Since about 1940, having given special attention to the distribution of this species, I have seen it in nearly 40 localities. My own finds and also those made by other botanists now make it possible to discern distinct features in the Swedish distribution of the species.

In Finland *F. julianus* was first found as a subfossil by Harald Lindberg (Lindberg 1896), who shortly afterwards found it cast up on the shore of the eastern tip of the Gulf of Finland (Lindberg 1898). The first discovery of a Finnish habitat was made by Maristo (1935).

Well developed specimens of *F. julianus* are shown on Pl. I. At very good supply of nutriments the shoots may grow higher than in the material of the picture. Under meagre conditions the stems may be as short as about 1 cm.

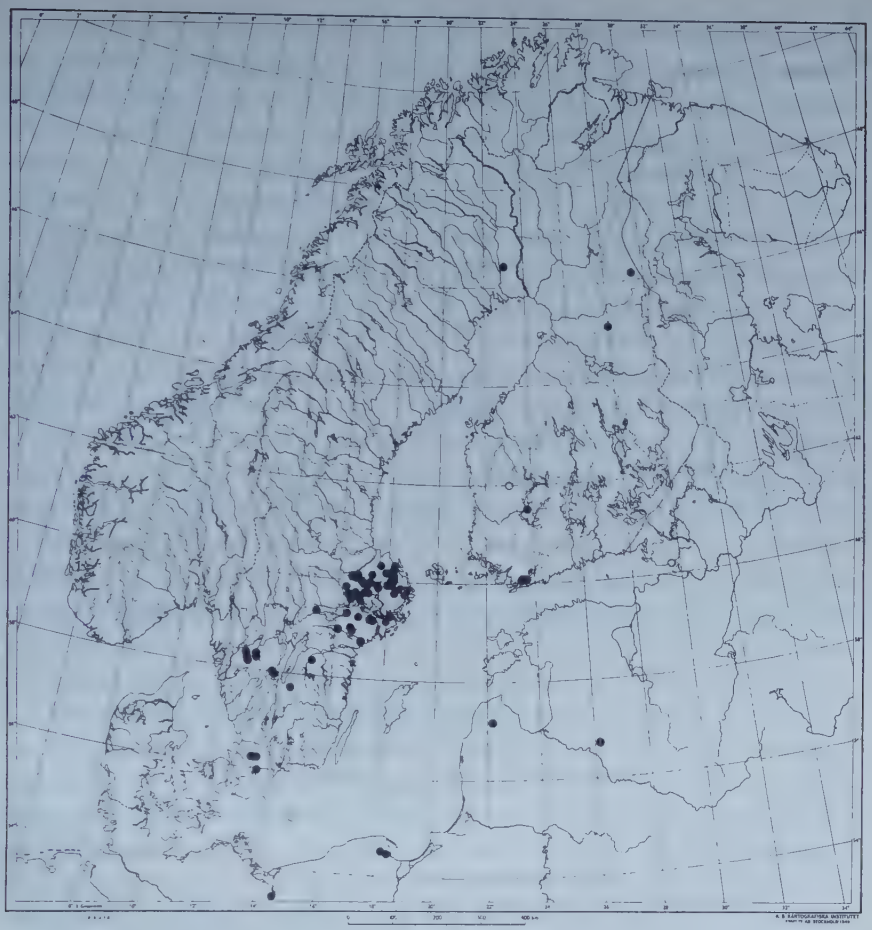

Fig. 1. The distribution of *Fissidens julianus* in Northern Europe. Empty circles mark the Finnish finds of subfossil material and of material cast up on the seashore.

The distribution of *F. julianus* in NW. Europe is shown on the map in Fig. 1. The most prominent feature of the distribution is the concentration of localities in the provinces round Lake Mälar and the rareness or absence of the plant in the rest of the area mapped. Like *F. julianus* some other water plants have numerous localities in the provinces round Lake Mälar, for instance *Potamogeton mucronatus* and *P. zosterifolius* (Samuelsson 1934, pp. 118, 134), *Ricciocarpus natans* (Lohammar 1940), and *Hildenbrandia rivularis* (Israelson 1942, Luther 1954), but they differ clearly from *F. julianus* in having numerous localities also in the province of Skåne and in Denmark.

New localities for this interesting moss species may of course be discovered, but I believe that they will not considerably change the main features of the distribution now known. I wish to point out here that the plant has been sought after in vain over large parts of Sweden. I have looked for it unsuccessfully in many rivers and rivulets in the provinces of Skåne and Blekinge, in the coastal regions of the administrative district ("län") of Kalmar and the province of Östergötland, in the peninsula of Södertörn (S. of Stockholm), and on the island of Gotland. I have sought for it without success also in lakes and rivers in the provinces of Gästrikland, Hälsingland, and Dalarna, further on in those parts of the province of Västmanland which are situated west of the river Svartån, and in the province of Dalsland. In the company of Dr. H. Luther, Helsingfors, I have looked for it in several rivers in SW. Finland.

Krusenstjerna (1945) has treated the moss flora and moss vegetation in the neighbourhood of Uppsala, and his paper gives some information on the ecology of *F. julianus*. He points out that the species is a "euhydrobiont" and mentions the water plants accompanying it.

F. julianus grows in lakes, in rivers and rivulets. The great majority of the finds were made in clearly eutrophic waters, but the plant can also live in moderately eutrophic water which is demonstrated by its presence in Lake Posjärv in the province of Norrbotten; however, at least one fastidious phanerogam, *Lemna trisulca*, lives in that lake (Lohammar 1938). I have never seen *F. julianus* in obviously oligotrophic waters.

Like many other water plants with high nutritional demands, *F. julianus* is, within certain limits, evidently favoured by human culture. In richly eutrophized waters, for instance Lake Kärven in Uppland (Lohammar 1938) and in the river Olandsån, which receives part of its water from Lake Kärven, I have seen large and bushy specimens of it; but a heavy supply of waste water may kill the species. During the hot and dry summer of 1947 certain sections of the river just mentioned got badly polluted by domestic sewage because the amount of water in the river was very small. In the summer of 1940 I saw *F. julianus* growing richly in the river Olandsån near the church of Hökhuvud, but in the autumn of 1947 I could no longer find it at the same place in the malodorous water. In the river Strömarån in northern Uppland I found it in 1947 at Hillebola, which is situated about one kilometre down the river from

Lake Strömaren, but while the river water passed down the cultivated landscape it got polluted and I could not detect the moss on the stones in the river neither at Åkerby about 10 km down Hillebola, nor at the church of Österlövsta, some kilometres further down.

During the years of World War II, I saw *F. julianus* growing abundantly on the stones of Kvarnfallet in Uppsala (Pl. II), but it seems to me that the species has later decreased and that coarse filamentous algae have increased, a development which may be the result of the great increase after the war in the use of artificial fertilizers in the fields of the basin of River Fyris, and of the removal of fertilizers by drainage water. During my excursions in the province of Västergötland in 1952, I looked in vain for *F. julianus* in the rivers Tidan and Flian; their water is considerably polluted, and I find it possible that the moss lived earlier also in these rivers but was eradicated by sewage.

Many of the habitats in the provinces round Lake Mälar are situated slightly above sea level. In Småland the moss was found 270 m above sea level, which is the greatest altitude known from Northern Europe for *F. julianus*.

Under normal water conditions it grows only submerged. It often appears just below the summer low-water level. The commonest substratum is rock, solid rocks as well as boulders and stones. The pictures of Pl. II show habitats of this sort. When the plant lives on rocks which incline sharply into the water, it is often accumulated in or completely restricted to crevices. This may be explained by the circumstance that the crevices afford protection against ice erosion, but may also be connected with the tendency of the plant to prefer shaded habitats. Small submerged rock-pools (Swedish: *hällkar*) in the falls and rapids of the rivers are often rewarding hunting-grounds for *F. julianus*. Only rarely did I see it on old tree branches lying in the water.

A remarkable feature is the appearance of *F. julianus* on shells of living and dead lamellibranchs. In Lake Mörtsjön at Länna bruk, in the province of Södermanland, I found it in 1940 growing both on stones near the off-flow of the lake and on the shells of living specimens of *Anodonta cygnea* (det. B. Hubendick); the mussels wandered about carrying a luxuriant "moss-fur" (cf. Pl. I). Later on I have seen it attached to living mussels also in two localities in Uppland, Lake Strandsjön and the outflow-river of Lake

Hallaren. Luther found it in the Pojo Bay in SW. Finland growing on shells of dead *Anodonta* at a depth of 2.7—2.9 m (Luther 1951) and further in River Svartån, an influx of the Pojo Bay, at a depth of 2—4 m, on shells of living *Anodonta* and *Margaritana* (in litteris). The vegetation on the shells of mussels is usually very scanty, and I have seen no other moss occurring in this manner.

F. julianus can also grow attached to the stems of larger moss species. In 1939 I found it sparsely as an epiphyte on *Rhynchostegium riparioides* (= *rusciforme*) and *Drepanocladus aduncus* at about one metre's depth in the western end of Lake Erken in Uppland. (In the autumn of 1947 I looked for it in vain at the same locality; for an unknown reason the numbers of the two other mosses mentioned had greatly diminished.)

Furthermore *F. julianus* can grow entangled in mats of larger mosses (without being epiphytically attached to them?) and perhaps also lying free on loose mud. In Lake Posjärv, mentioned above, I found it in the southern bay at about one metre's depth (Lohammar 1938, Tafel 30). Other moss species form thick and wide mats on the bottom of the bay, and if I remember correctly, the plant was entangled in the mats. (In 1945 I visited the lake again in order to study the ecology of the species but could not refind it.) Mr. Lars Dahlgren gave me the following information about the ecology of *F. julianus* in Lake Viren, Södermanland. It grows abundantly, entangled in *Cladophora aegagropila*, *Fontinalis antipyretica*, *Rhynchostegium riparioides*, and two species of *Drepanocladus* at a depth of 1.5—2 m. Scattered specimens of *Utricularia vulgaris* and *Potamogeton obtusifolius* also belonged to the community. At about 2.8 m depth it was found attached to the disk-shaped pieces of lake-ore, as was also *Cladophora aegagropila*. On the initial stones in the middle of the ore pieces there also lived *Hildenbrandia rivularis* and *Heribaudiella fluviatilis*. The other mosses just mentioned were found between the ore pieces.

Maristo (1935) says that *F. julianus* was found in Lake Näsijärvi in Finland on loose mud at a depth of 2—2.8 m outside the clumps of *Sparganium friesii*. The area of the habitat was about 20 m broad and 300 m long. "Die am reichlichsten auftretenden Arten sind *Fontinalis antipyretica*, *F. antipyretica* var. *gracile* und *Philonotis fontana* f. *laxifolia*. In diesem Bestande wächst *F. Julianus* als sehr zartes Pflänzchen von 5—7 cm Länge zerstreut, aber doch so dicht, dass es in fast jeder Probe enthalten war."

Ozolina (1931) describes the habitats of the moss in Lake Usma in Latvia as follows: "Auf Untiefen von 3—4 m Tiefe wo sie in *Drepanocladus aduncus* und *Rhynchostegium rusciforme*-Beständen vorkommt."

On the whole, according to my observations, *F. julianus* prefers more or less shaded habitats. It may even grow in very shaded places under overhanging rocks and in narrow crevices. In order to find the plant in shallow rivulets it may be necessary to turn over the stones on the bottom, because no specimens are visible from above. The light supply must be highly reduced also when it grows some metres down in lakes and rivers, as mentioned above. Its light amplitude is, however, so wide that it can live also in sunny sites up to the low-water level. In the places where I have found it on rock substrata, it occurred from the normal low-water level down to about $^1/_2$ metre's depth. Judging from my experience, it appears more richly and more frequently at the western shores of the lakes than at the eastern ones; this may possibly be connected with the half-shade given by trees and thickets at the shores during hot afternoon hours or with the more sheltered position in regard to the predominant winds during the summer.

Contrary to many other water mosses *F. julianus* is not winter hardy. A stone overgrown with the moss was placed during the winter in a cold-storage room and incapsulated in ice at —5° C. All the shoots were killed by the treatment. (I cannot tell if the basal parts attaching the moss to the stone were killed as well.) It may thus be surprising to find that a species so sensitive to cold can grow up to the low-water level of the summer. The water level of the lakes in Northern Europe is, however, as a rule comparatively high late in the autumn when the coating of the lakes with ice begins, and it often happens that the ice cover later becomes a slanting roof at the shores (cf. Pl. III). Snow often accumulates on the shores, and according to differences in the depth of the snow cover the ice cover may vary greatly in thickness; sometimes it is only a few centimetres thick by the shores, even if it is 30—50 cm thick further out from the shores, where the snow cover is smaller. In Lake Storsjön in Västmanland I have seen variations in the amount of *F. julianus*, which I attribute to winter damage; in the summer of 1940 I found the plant growing abundantly almost up to the low-water level, but the next summer — after a hard winter — it grew

only rather sparsely and rather deeply in the same habitat (the water level was about the same on my two visits).

During the warm and dry summer and autumn of 1947 the water level sank far below the normal low-water levels. This happened for instance in Lake Hallaren in NW. Uppland, and mats of *F. julianus* were then exposed to the air for several months (cf. Pl. III). The shoots dried up and undoubtedly died. At this extreme low-water level the covering with ice took place, and the material was exposed for some time to the contemporaneous frost at the beginning of the winter. When I visited the place in the following summer, I expected to find no living remains of *F. julianus* on the boulder, but much to my surprise I found vigorous shoots of it again covering the surface of the boulder. This may be accounted for by the basal parts having greater power of resistance to drought and frost; closer observations into this phenomenon would be of great interest. As an example of other dangers menacing the existence of the moss, I should like to mention here that only very slight remains of it existed in September 1953 on the boulder pictured; the rock surface was instead covered with a splendid colony of a *Spongilla* species.

Amblystegium riparium is a very common companion of *F. julianus*. These plants often grow mixed, but *A. riparium* alone proceeds a bit above the water level. On rocks at Lake Erken in Uppland I have seen *A. riparium* growing *above* the water level, but not below the very level of the low-water. My interpretation of this is that Gastropoda eat it away in the water. By the shores pond snails are found abundantly in the water, for example *Vivipara vivipara* and *Neritina fluviatilis*. I have already mentioned that I have observed *F. julianus* living as an epiphyte on coarser mosses in Lake Erken. To a large extent the shores consist of rocks, boulders and stones, so that the chances of finding *F. julianus* seem good, but I have never been able to find it there on a substratum of rock. I have the opinion that the snails keep it away from the rock surfaces of the shores in the same way as they keep *A. riparium* away from the water. The snails seem to be far fewer in number in sparse moss mats on loose mud than on rock surfaces, and so *F. julianus* can exist in those mats as an epiphyte. In other lakes, too, I have found that there is no use trying to look for *F. julianus* if there are a great many snails on the rock surfaces.

In glass aquaria I have placed *Limnaea stagnalis* and *Planorbis corneus* and the following mosses: *Fontinalis antipyretica*, *Drepano-*

1. *Fissidens julianus* from Lake Strandsjön at Järlåsa in the province of Uppland. Natural size. — Photo by the author.

2. A bushy growth of *F. julianus* on the shell of a living *Anodonta cygnea* from Lake Mörtsjön at Länna in the province of Södermanland. Natural size. Photo by the author.

1. Kvarnfallet (="the Mill-Fall") in River Fyrisån in Uppsala at extreme low-water level. The boulders in the rapid were richly covered with *F. julianus* and other moss species. — 26.10. 1947. Photo by the author.

2. A rock tongue in Lake Strandsjön, Uppland, at extreme low-water level. *F. julianus* was found laid bare as well as submerged on flat rocks and boulders and on mussels between the boat and the camera. — 10.11. 1947. Photo by the author.

1. Lake Strandsjön, Uppland. Hole cut out in the ice. As shown by the picture the ice-cover slants strongly at the shore. The position of the water surface has been marked by a white line. *F. julianus* lived on stones in the shallow water under the ice up to the big boulder rising out of the snow. — 24.2. 1946. Photo by the author.

2. A boulder c. 50 m north of the bridge over Lake Hallaren in the province of Uppland. The water level is extremely low so that the carpet-like mat of *F. julianus* (+ some few specimens of *Fontinalis antipyretica*) has been laid bare and dried up. *F. julianus* ends about 5 cm above the water, and its vertical amplitude on the boulder is about 35 cm. The upper limit of the moss carpet has been marked by a chalk line. (The length of the boulder is about 1.2 m.) — 26.9. 1947. Photo by the author.

cladus aduncus and *Fissidens julianus*, the last-mentioned species together with algae growing on stones. The snails grazed on the leaves of *F. julianus* but left the two other mosses intact.

Just as the snails can locally affect the occurrence of *F. julianus*, they can probably influence its distribution over large areas in a negative direction. Denmark and Skåne have a very abundant fauna of snails in the eutrophic waters, and I find it logical to combine the absence, or rarity, of *F. julianus* with the presence of the snails.

Sometimes *F. julianus* is missing very surprisingly without my seeing a reason for it; the plant lives for instance in Lake Tämnaren in northern Uppland but has been looked for in vain in the outflow of Lake Tämnaren, Tämnarån, which has a rich moss vegetation in all the rapids.

F. julianus has never been found fertile in Northern Europe. Its dispersal within these parts of Europe can therefore be supposed to take place only vegetatively. Its appearance on the shells of living mussels bears evidence toward both rapid and effective spreading.

I consider it probable that *F. julianus*, like many other eutrophic water plants, had a wider distribution and higher frequency in the northern parts of Fennoscandia during the postglacial climatic optimum. The changes in the chemistry of soils and waters following the climatic changes ought to have reduced the number of suitable habitats on a large scale. Viewed against this hypothetical background, the isolated locality in northernmost Sweden (66° 28′) and the two localities in northern Finland may be considered to have the nature of being relicts.

Localities.

Abbreviations:

(L) = Herbarium of the Botanical Museum of Lund.
(S) = „ „ Naturhistoriska Riksmuseum, Stockholm.
(U) = „ „ the Botanical Museum of Uppsala.
! = own observations.

Since the list of localities is of interest mainly to North European botanists, it has been written in Swedish.

Sverige.

Skåne.

Oderljunga: Fjellramsjön, i vattenlinjen på hällarna vid ett uppstickande grund, 1941! (U). — Bälingesjön, på stenar på 1—2 dm djup, 1942, S. Lillieroth (S). — **Röke:** Humlesjön, på stenar på 1—2 dm djup, 1942, S. Lillieroth (S). — **Tjörnarp:** Tjörnarpssjön, 1949 Asta Lundh (S).

Småland.

Barkeryd: Boarp i Ribbingsnässjön på 3—4 fots djup, 1884, H. W. Arnell (S, U). D:o 1885 (S, U). D:o 1889, A. Arvén (S).

Västergötland.

Sandhem: Sandhemssjön (= Sjöbackasjön, Jensen 1939), 6 fot djupt, 1887, H. W. Arnell (U). — **Habo:** Furusjön (= Nykyrka i Jensen 1939), Th. G. Halle. — **Essunga:** St. Krokstorp, i Nossan, 1952! (U). — **Främmestad:** Baljefors, i Nossan, 1952! (U). — **Tengene:** Mariebergs kvarn, i Nossan, 1952! (U). — **Tråvad:** Algustorp, i Lidan, 1952! (U). — **Uvered:** Bro kvarn, i Lidan, 1952! (U).

Östergötland.

V. Harg: Borgsjön, på undervattensklippan »Bykholmen», 1857, H. von Post (S, U).

Närke.

Hovsta: Kåvi, på sten i sjön Lången vid ett stenkummel mitt i sjön, 1932, S. Waldheim (S).

Södermanland.

Stockholm: Söderbysjö, på stranden bland Fontinalis hypnoides, nov. 1853, S. O. Lindberg (S). — Nacka bro, 1855, S. O. Lindberg (U). D:o 1868, W. Berndes (S, U). — **Nyköping:** vid Karlfors kvarn, 1941! (U). — **Blacksta:** Eknäs kvarn, sparsamt på kvarnrännans stenmur, 1940! (U). — **Huddinge:** Orlången nära Stensätra på klippor och stenar 10—20 cm under vattenytan, 1947 P. Kaaret (S) (Kaaret 1953). — **Husby-Rekarne:** Rosenfors, kraftstationens spillränna, sparsamt på ett par ställen på stora block, 1940! (U). — **Länna:** Länna bruk, Mörtsjön, rikligt vid sjöns avlopp på stenar och levande dammusslor, 1940! (U). — **Sköldinge:** Varbro kvarn, sparsamt på små stenar på bottnen av bäcken på ett lugnare, djupare avsnitt mellan kvarnen och nya landsvägsbron, 1940! (U). — **Turinge:** Ryssjön, grundet närmast Sjöänden, 1944, Th. G. Halle (S). — Långsjön på 1—2,5 m:s djup, 1944, Th. G. Halle (S). — **Ö. Vingåker:** Viren, ö. delen på 1,5—2 och 2,8 m:s djup, 1953, Lars Dahlgren (U).

Uppland.

Almunge: Skärsjön, 1943, Israelson och Rodhe. — **Alunda:** Stamsjön, 1870, G. Theel (U). Ytterligare exemplar (S, U) insamlade av G. Theel och R. Hartman samma år i Alunda kunna antagas vara samlade på samma ställe. Det är för övrigt troligast, att materialet i själva verket insamlats vid Stamsjöns södra klippiga strand, som tillhör Faringe s:n — inom sjöns Alunda-del har jag icke sett växten. — **Bred:** Bredkvarn, i Sagån, 1942! (U). — **Bälinge:** Ulva kvarn, på stenar i Fyrisån, 1938, E. v. Krusenstjerna (S). D:o 1942! (U). — Tämnaren, Sörsjön, på block, 1939! (U). —

Börstil: Olandsån vid landsvägsbron vid Lesan, 1947! (U). — **Ekeby:** Olandsån, ungefär mitt emellan Charlottendal och byvägsbron vid Fors, 1940! (U). — Olandsån, Väskinge vid landsvägsbron, 1940! (U). — **Enåker:** Kölfors, rikligt på stenar i ån vid landsvägsbron, 1940! (U). — Hallarsjöbro, på block i sjön Hallaren, 1940! (U). — **Estuna:** Gillfjärden, på den stora klippan, som stupar brant ned i sjöns västända, 1945! (U). — **Faringe:** Stamsjön, rikligt på hällar och block på sjöns sydsida, 1940! (U). Jfr ovan Alunda. — **Fasterna:** Mörby, på stenar i Skedviken, 1939! (U). — **Film:** Österbruk by, kvarnen, rikligt på stenblock, där turbinrännan och spillrännan sammanflyta, 1940! (U). — **Forsmark:** Kallrigafjärden på 2,5—3 m:s djup, 1950 (Luther 1950, 1951). — **Fröslunda:** Alstasjön, på den branta västligaste klippan på sjöns sydsida, 1940! (U). — **Härnevi:** Vånsjöbro kvarn, 1940! (U). — **Hökhuvud:** Olandsån, rikligt på stenar vid bron vid kyrkan, 1940! (U). — **Järlåsa:** Grissjön, 1940, Du Rietz (muntligt meddelande). — **Knutby:** Kärven, rikligt på block och hällar vid Djupudden (ca 1_2 km NE om Kärvsnäs), 1940! (U). — **Lohärad:** Erken vid Kristineholm, epifyt på grövre mossor, 1939! (U). — **Norrtälje:** vid vattenkvarnen, 1941! (U). D:o 1945 F. Agelin (S). — **Roslags-Bro:** Utålsviken, 1953 T. Willén (U). — **Skogstibble:** Strandsjön, rikligt på klippor, block och stenar, 1939! (U). — **Tierp:** Tämnaren, klippudden Vårhäll, 1938, G. E. Du Rietz (Krusenstjerna 1939). — **Tillinge:** Nykvarn, nedanför fallet, 1942! (U). — **Uppsala:** Kvarnfallet, 1938, E. v. Krusenstjerna (S, U). D:o 1939 etc.! — **Vittinge:** Morgongåva, Ramsjön, rikligt på block vid västra stranden, 1940! (U). — Morgongåva, Axsjön, 1940! (U). — **Västerlövsta:** Molnebo, i bäcken strax nedanför landsvägsbron, 1940! (U). — **Österlövsta:** Hillebola, Strömarån vid landsvägsbron nedanför bruket, 1947! (U).

Västmanland.

Fläckebo: Fläcksjön, rikligt på stenblock vid östra sidan av Stenhusholmen (= »Ebba Brahes holme»), 1940! (U). — **Möklinta:** Storsjön, rikligt på smärre block vid berghällarna vid Klinta, 1940! (U). 1947 observerad på flera olika ställen i sjön! — **Sevalla:** Herrkvarn, på stenar och hällar nedanför dammen, 1942! (U). — **Skultuna:** Skultuna bruk, sparsamt på stenblock omedelbart nedanför landsvägsbron, 1940! (U). — **Västerås:** kvarnforsen, på de nedersta blocken, 1940! (U).

Norrbotten.

Överkalix: Posjärv, sjöns södra vik i närheten av mittlinjen på ca 1 m:s djup, 1930! (U).

Finland.

Regio aboënsis.

Karis: Svartån i utloppet från Karis kyrksjö i huvudströmfåran på 3 m:s djup på skal av levande musslor (på 1 *Margaritana* av 5 undersökta och på 2 *Anodonta* av 35 undersökta, icke anträffad på 25 döda musslor),

1951 H. Luther. — Svartån ovanom Landsbro (Dönsby Forsvik) på 3 m:s djup på musslor (gles päls på 4 musslor av 6 undersökta), 1951 H. Luther. — **Pojo:** Svartån vid Billnäs såväl nedanför dammen på 2—3,8 m:s djup här och där på musselskal som ovanför och nedanför landsvägsbron på 3—4 m:s djup sparsamt på levande *Margaritana*, 1952 H. Luther. — Svartån vid Åminnefors i strömfåran nedanför dammen på 1,5—2,5 m:s djup sparsamt på levande *Margaritana*, 1952 H. Luther. — Gumnäs, Pojoviken, 2 lokaler, 1945 H. Luther (Luther 1951 I, II).

Tavastia australis.

Aitolahti: Näsijärvi, Laalahti, L. Maristo (Maristo 1935).

Satakunta.

Ikaalinen (Ikalis): subfossil i Parkanojokis älvsandavlagringar norr om Ikalis (Lindberg 1896).

Ostrobottnia kajanensis.

Puolanka: Suolijärvi, Siikajärvi, 1952 J. Salonen (Kotilainen & Salonen 1954).

Kuusamo.

Kuusamo: Vuotunki, Suorajärvi, 1953 J. Salonen (Kotilainen & Salonen 1954).

Karelska Sovjetrepubliken.

Isthmus karelicus.

Terijoki: »i mängd uppkastad på stranden mellan Kuokkala och Afanasi (Kivinebb) vid Finska viken» (Lindberg 1898) »tills. med *Pot. gramin.*, *Fontinalis antip.*, *Elodea*, *Cladophora* etc.», 1896 H. Lindberg (S). Materialets proveniens är oviss, men troligen har det icke drivit långa vägar över havet.

Lettland.

Kurland.

Usma-sjön (Ozolina 1931).

Livland (= Vidzeme).

I floden Aiviekste vid Saviena (Malta 1930).

Summary.

Some data on the history of the discovering of *Fissidens julianus* in Northern Europe are given.

A map of its distribution is published on p. 163.

The plant lives in ± eutrophic water in lakes and rivers and very rarely (occasionally?) in brackish water.

It grows attached to rocks, boulders, stones, branches, shells of mussels, and coarser mosses or entangled in other mosses; perhaps

also free on loose mud. It was found from the normal low-water level down to a depth of about 4 m.

The plant may be damaged for instance by sewage, by drying up, by frost and pond snails. The abundance of the snails may cause the absence of the moss locally as well as regionally.

A list of all known localities in Northern Europe is published.

I owe sincere thanks to Dr. Herman Persson, Stockholm, who has determined my collections of aquatic mosses and who taught me to recognise *F. julianus*.

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SYDVÄXTBERG.

av

G. EINAR DU RIETZ.

Ett av de i våra dagar mest omstridda ekosystemen[1] i norra Skandinaviens natur utgöres av de »i mera än ett afseende märkliga sydberg — naturens drifbänkar om man så vill, hvilka hysa talrika sydskandinaviska arter långt norr om gränsen för dessas mera sammanhängande utbredningsområde» (Andersson och Birger 1912 s. 14). Uppmärksammade redan av Linné, som under sin »Iter Dalecarlicum» 1734 »nedanför brandta bergsklippan» på Hykjebergets sydsida på »en smal grön plats» konstaterade närvaron av lönn, lind och flera örter, »hvilka wäxter fuller älliest i Swerige äro allmänna, men här uppe mycket främmande» (Linné 1873 s. vi, 1953 s. 44 och 204), voro sydbergen omtalade och beskrivna av talrika författare i 1800-talets och början av 1900-talets växtgeografiska litteratur, då Andersson och Birger 1912 gjorde sin stora sammanställning av allt vad som genom deras egna och tidigare forskares arbeten då var känt om dessa utposter av sydskandinaviska arter i norra Sverige och samtidigt försökte skapa en ändamålsenlig terminologi genom att »föreslå namnet *sydberg* för hela den fysiskgeografiska enhet, i hvilken själfva ståndorten för de sydskandinaviska arterna utgör en del», däri inläggande »att dessa berg ha en tvärbrant mot söder exponerad sida».

Talrika författare hade före Andersson och Birger framhållit solexpositionens betydelse för dessa nordliga utposter av sydliga arter.

[1] »In an ecosystem the organisms and the inorganic factors alike are *components* which are in relatively stable dynamic equilibrium.» (Tansley 1935 s. 306. Jfr även Tansley 1939 s. 228.) Sådana av organismvärlden och dess livlösa miljö, av biocoenos och biotop, sammansatta jämviktssystem ha även kallats Holocoen (Friedrichs 1937, Thienemann 1941, Julin 1948), Biosystem (Thienemann 1941) och Biogeocoenos (ryska författare enligt Sucatjev 1954). Termen »ecosystem», vilken nu ofta användes i engelskspråkig litteratur, synes av många orsaker vara den lämpligaste.

»Lönn och Linn finnes blott i en enda bergsida där solreflexionen är särdeles stark, och på samma ställe träffar man tvenne usla Hasselbuskar», skrev Wahlenberg (1809 s. 218) om trakten av sjön Yngen i östra Värmland.

»Man finder under bratte Bergvægge gjerne Urer af nedrasede Stene», skrev Blytt (1876 s. 287–289) som inledning till en utförlig skildring, ur vilken följande utdrag må anföras: »Dersom Uren har en heldig Beliggenhed mod Solen og Forholdene forøvrigt ere gunstige, finder man en særdeles rig och afvexlende Flora . . . Det er i saadane Urer, at vore Løvtræer trives bedst og have sin største Udbredelse . . . Under disse steile Klippemure raader paa klare Sommerdage ofte en brændende Hede. Lind (Tilia parvifolia), Alm (Ulmus montana), Hassel (Corylus Avellana), Eg (Quercus pedunculata), Løn (Acer platanoides), Asal (Sorbus Aria), Birk (Betula verrucosa), Ask (Fraxinus excelsior), Roser (Rosa dumetorum, canina, mollissima), Hagtorn (Cratægus monogyna), Cotoneaster vulgaris, Æbletræet (Pyrus Malus) — kortsagt en Mængde af vore mere kuldskjære Løvtræer og Buske danne i saadanne Urer Smaaskov og Krat, som, hvis de ei ere altfor tætte, skygge over en rig og afvexlende Flora . . .»

»Det är *uteslutande* på sådana lokaler vettande mot söder eller sydost, vi norr om Indalsälvens utlopp finna hasseln», skrev Andersson 1902 (s. 133) om de solexponerade »bergrötter», om vilkas värmeklimat han bl. a. yttrade följande (s. 134): »Där solstrålarna på grund av markens lutning infalla nästan vinkelrätt och där ofta fullständigt skydd råder mot alla kalla vindar, är temperaturen påtagligen afsevärt högre än inom omgifningarna vanligen är fallet. Afkylningen under nätterna blir ej heller någonsin så stor som i de nedanför liggande dalgångarna, dit den kalla luften sänker sig ned.»

Holmgren (1909 s. 64) fann på almens norrländska utpostlokaler i bergrötter, att »den värmemängd, som å dessa lokaler kommer vegetationen till del, är betydligt större än å andra närbelägna platser».

Anderssons och Birgers (1912 s. 65) åsikt om det väsentliga i sydbergens lokalklimat framgår klarast ur följande sammanfattning:

»Sydbergens klimatiskt största förmån framför alla andra ståndorter är dock den stora värmemängd, som på grund af den starka insolationen kommer dem till godo. Solstrålarna infalla under lång tid af dagen i vida gynnsammare vinkel än på jämn mark, hammaren uppvärmes starkt och utstrålar under natten stora värmemängder, väl hufvudorsaken till att sydbergen äro så allmänt kända för sin

frostfrihet, att befolkningen, då de ligga i byggdens närhet, mångenstädes där röjt sig sina potatisåkrar . . .»

Det för varje fältiakttagare uppenbara värmeöverskottet i sydbergen i förhållande till trakten i övrigt belystes av Frödin (1915) med en serie temperaturmätningar i Lule lappmark.

Anderssons och Birgers arbete blev en stark stimulans för fortsatta sydbergsforskningar i vårt land, men framkallade också kritik. Mot Anderssons och Birgers starka betonande av sydbergens och deras gynnsamma temperaturförhållandens betydelse för de sydskandinaviska växtarternas förekomst i norra Sverige riktades kritik redan av Hesselman (1913 s. 317) i hans recension av boken ifråga. Enligt Hesselman »hade det dock utan tvifvel varit af stort värde, om författarna mera strängt, än hvad de nu gjort, skilt mellan sydberg och andra gynnade växtplatser i Norrland, i hvars vegetation sydskandinaviska arter spela en mera framträdande roll. Icke få af dessa sydskandinaviska arter förekomma nämligen vid gränsen för sin utbredning ingalunda endast i sydberg, utan på allehanda lokaler, ofta på sådana med särskildt god mark. Skiljas icke de olika ståndortslagen från hvarandra, är fara värdt, att man tilldelar den högre temperaturen i sydbergen en alltför stor roll, åtminstone för vissa arter.» Men redan Andersson och Birger framhöllo (1912 s. 43), om »de sydskandinaviska arternas förekomst» i norra Sverige, att man visserligen skulle »kunna vänta att i områden, där sydberg och andra lokalklimatiskt särdeles gynnade ståndorter äro synnerligen sällsynta eller öfver stora sträckor helt saknas, dessa arter äfven skulle vara frånvarande», men att »så är emellertid ingalunda fallet», och anförde som exempel, att »på den jämtländska silurslätten och i än högre grad på Dalarnes silur finnas å talrika lokaler på jämn eller ringa sluttande mark större eller mindre antal af de sydskandinaviska arterna».

Tengwall (1925 s. 768) jämförde floran på syd- och nordexponerade branter i Rapadalen (Sarek) och kom därvid till följande uppfattning: »Die Beispiele, die oben aus dem Rapadalen angeführt wurden, zeigen jedoch, dass es 'Südberge' mit nördlicher Exposition gibt. Dass die meisten Südberge eine südliche Exposition besitzen und dass die Anzahl von Südbergpflanzen dort grösser ist als auf den übrigen 'Südbergen', ist sicher grösstenteils auf die topographischen Verhältnisse in den Fjelden zurückzuführen. Im allgemeinen scheinen mir die nördlichen Talseiten eine reichere Auswahl an solchen Standorten zu besitzen, die die Südbergpflanzen vor-

ziehen. Damit will ich keineswegs bestreiten, dass wenigstens für einen Teil der Südbergarten die Temperaturerhöhung, die durch die südliche Exposition verursacht wird, eine gewisse Rolle spielt.»

Halden (1931 s. 425) påpekade, att »bland förutsättningarna för den s. k. sydbergsfloran i norra Sverige påvisade G. Andersson och S. Birger i sitt grundläggande arbete av år 1912 icke blott sydlägets utan även markfuktighetens och kalkens roll», men att »en rätt så utbredd tendens hos forskare, som fortsatt sydbergsstudiet, synes vara att överskatta sydlägets betydelse». Han anförde exempel på att kalkförekomster upptäckts i sydberg där frånvaro av sådana tidigare antagits, och på »talrika lokaler med genomsipprad mark i annan exposition» med sydlig vegetationstyp, vilket visar »att sydlägets roll icke får överskattas, då det gäller floran i Norrland».

Wistrand (1934 s. 15) skrev efter en skildring av floran i öst- och nordöstbranterna av Svartberget nära byn Högheden vid övre Hornavan i Pite lappmark: »Att floran trots orienteringen mot öster och nordost är så rik, bekräftar en ofta gjord iakttagelse, att sydberg, särskilt om berggrunden är kalkrik, mycket väl kunna vara orienterade mot annat väderstreck än söder.» Denna användning av termen »sydberg» strider dock mot följande mening i Anderssons och Birgers (1912 s. 52) definition: »Vi vilja däri lägga, att dessa berg ha en tvärbrant mot söder exponerad sida.»

Grapengiesser (1934 s. 303) kritiserade Anderssons och Birgers starka framhävande av insolationens betydelse för sydbergens sydskandinaviska flora: »Efter de iakttagelser jag gjort, har jag allt mer kommit till den övertygelsen, att insolationsfenomenet icke bör tillmätas så stor betydelse, när det gäller bergen i kustlandet och ej ens i det närmare inlandet. Först när man kommer till fjällen, finner man att sydläget har en påtaglig betydelse för vegetationen. Äro ej övriga förutsättningar förhanden i ett kustlandets sydberg, nämligen den kalk- och mineralrika vittringsjorden samt tillräcklig bevattning, då erbjuder sydbergets såväl hammare som rot intet utöver vad traktens flora i övrigt har att uppvisa. Å andra sidan kan det bergs nordstup, som äger förmånen av dessa betingelser, vara hemvist för den mest utpräglade 'sydbergsflora'. En mångfald exempel härpå kunna framläggas . . .» Han åberopar Hesselmans, Haldens och Wistrands ovan anförda synpunkter och drar ur sina egna och deras iakttagelser följande slutsatser (s. 304–305):

»I följd av det nu sagda måste ifrågasättas, huruvida termen 'sydberg' är lämplig för att i allmänhet beteckna ett berg med

sydskandinaviska arter, helst som man väl måste i likhet med Andersson och Birger, vilka stå som auktorer för termen, 'däri lägga att dessa berg ha en tvärbrant mot söder exponerad sida' (7, sid. 52). Författarna ha redan använt termen i vidsträcktare bemärkelse än definitionen berättigar till, då den i flera fall tillämpats på berg, vilkas stup äro vända mot andra väderstreck än söder. Detta innebär i sig självt en begreppsmotsägelse. Om mina nu beskrivna iakttagelser, vilka synas mig giva vid handen att det sydskandinaviska floraelementet ej nödvändigtvis är bundet vid bergens sydstup, äro riktiga, då kommer termen än mindre att täcka det begrepp, som den är avsedd att klargöra. I vissa fall måste det därför vara riktigare att använda benämningen 'brantberg', 'tvärberg' eller något dylikt uttryck, och jag kommer i det följande att upptaga det förstnämnda ordet. Därför behöva ej de lyckligt funna orden 'sydberg' och 'sydbacke' utmönstras; de giva ett gott uttryck för en sydligt exponerad lokal.»

Att det ligger en begreppsmotsägelse i att termen »sydberg» användes för varje berg med sydskandinaviska arter, även om bergets stup äro vända mot andra väderstreck än söder, däri har Grapengiesser uppenbarligen rätt. Lika uppenbart är »att det sydskandinaviska floraelementet ej nödvändigtvis är bundet vid bergens sydstup» och att »den kalk- och mineralrika vittringsjorden samt tillräcklig bevattning» i många fall äro nödvändiga förutsättningar för att sydlägets solexposition skall leda till utposter av sydliga arter. I denna riktning ha också Andersson och Birger (s. 60–65) själva uttalat sig, vartill Grapengiesser också hänvisar. Men lika litet som man bör överskatta insolationens betydelse, lika litet bör man underskatta den. Då Grapengiesser skriver att »först när man kommer till fjällen, finner man att sydläget har en påtaglig betydelse för vegetationen», synes mig detta knappast ha generell giltighet. Och hur lämpligt ordet »brantberg» än kan vara som beteckning på en viss typ av berg oberoende av expositionen, synes det dock icke tillräckligt karakterisera det ekosystem, som Andersson och Birger kallade sydberg och som utmärkes just genom kombinationen av en gynnsam solexposition med en påfallande anhopning av för trakten i övrigt främmande sydliga växter.

Schiöler (1934) gav inte endast en innehållsrik och åskådlig detaljskildring av några nordsvenska sydberg, vari begreppen »sydväxter» och »sydflora» infördes, utan även, trots konstaterandet om Skulebergets hasselbestånd att »den sydväxtförekomsten vände fak-

tiskt så att säga ansiktet mot nordost», en sammanfattning av solexpositionens betydelse för sydbergens växter, varur följande må anföras: »Det är uteslutande bergens byggnad och deras orientering åt solsidan, som är avgörande. Den stupande hammaren, den branta uren äro liksom byggda för att uppfånga solvärmen. En del därav återkastas omedelbart, en del magasineras i den upphettade stenen och avges efter hand under dygnets svalare timmar. Följden blir, att dessa branter snart sagt dygnet om få något högre temperatur än den omgivande trakten, vilket ju direkt gynnar värmekrävande växter. Därtill kommer att snön härav smälter tidigare. Och då därjämte den i stenen magasinerade värmen skyddar mot sena nattfroster om våren och mot tidiga sådana under hösten blir vegetationsperioden förlängd. Detta medför bl. a., att trädens årsskott mogna bättre och få större motståndskraft mot vinterkylan, att frukter och frön ha större möjlighet att fullbildas, samt att en gång blommande örter hinna fullborda sitt livslopp och lämna duglig avkomma eller åtminstone nå övervintringsdugligt stadium . . . Det för sydbergen karakteristiska kan således sägas vara, att de i ett mindre gynnsamt nordligt klimat skapa små oaser av ett mer gynnsamt sydligt sådant.»

Lange (1935) klarlade att av Jämtlands »ursprungliga sydskandinaviska arter» endast 16 äro »absolut bundna vid lokaler av sydbergsnatur», och gav talrika »exempel på de sydskandinaviska arternas förekomst å lokaler av icke sydbergsnatur». I namnfrågan yttrade han bl. a. följande: »Ehuru de skäl för namnändring, som Grapengiesser anför, äro fullt riktiga, bibehåller jag dock det gamla namnet, då detta synes mig ha vunnit en viss hävd, och någon anledning till missförstånd knappast kan befaras.»

Gaunitz (1939 s. 63) framhöll om sydbergen i Sorsele, att »några av bergstupen äro vända åt norr, men ändå finnes det en del sydbergsväxter i dessa nordberg». »För att undvika sådana motsägningar» kallade Gaunitz »de i förhållande till hela berget små lokalerna med från omgivningen avvikande flora för flyttj — ett Sorsele-dialektord för tvärbrant bergsstup». Björkman (1939 s. 209) fann detta ord »språkligt alltför tungt» och »alltför lokalt betonat». Han fann även termen »sydberg . . . mindre lyckligt vald». Icke heller Grapengiessers term »brantberg» fann han »tillfredsställande». Han föreslog »i stället helt enkelt rasbrant», därmed menande varje »kombination av brant och rasmark», och tillade: »För angivande av expositionen i varje specialfall kan vederbörligt väder-

streck sättas som prefix.» Sin erfarenhet om expositionens betydelse sammanfattade han bl. a. sålunda (s. 213): »I de rasbranter, som äro exponerade mot SO–S–SV når låglandsfloran sin bästa utveckling både i fråga om artantal, individmängd och yppighet. Även nordost-rasbranter såsom Kerkau-bergens kunna emellertid hysa ej så få av dessa arter, t. o. m. *Fragaria*, men individmängden är då alltid betydligt mindre och exemplaren visa lägre grad av vitalitet.»

Mot termen »rasbrant» i Björkmans mening kan invändas, att denna term av andra användes för varje brant sluttning med mer eller mindre instabilt material, alltså även där ingen klippbrant finnes, och att termens användning för kombinationen av brant och rasmark knappast synes språkligt invändningsfri och knappast torde vara begriplig för med Björkmans definition obekanta läsare.

Selander (1950 s. 144) vänder sig mot Tengwalls starka betonande av förekomsten i Rapadalen av »Südberge mit nördlicher Exposition» (jfr ovan s. 176) och påpekar att »on the steeps mentioned by him only very few lowland plants occur, none but *Polypodium vulgare* being an indubitable southern immigrant». Selander tillägger: »It would, in fact, be very extraordinary if his assertion were true, seeing that a slope of as little as 5° towards the pole reduces soil temperature approximately as much as 300 miles of latitude in the same direction (Daubenmire 1947 p. 177).» De »one or two steeps facing north though possessing a flora of partly southern character», som Selander fann i SW:a Lule lappmark, anser han vara »sheer exceptions». »To the west of the mountain range practically no lowland species occur on steeps facing another quarter than south and south-west. Even in the birch belt there are nearly always snow-beds below the wet northern steeps» (Selander 1950 s. 144–145). Som »the most striking instance of the significance of exposition» avbildar och beskriver Selander en sydbrant och en nordbrant »on the same hill, at the same altitude, about 610 m s. m., and at a mutual distance from one another of only about 2 km» samt »of an identical geological nature»: »Nevertheless, the differences in insolation, humidity and date of the melting of the snow and, consequently, in the length of the growing season occasion dissimilarities between the floras of the two steeps that are surprisingly marked.» Medan den avbildade snörika nordsidan endast hyser fjällväxter, finner man på sydsidan på samma nivå fjällbjörkar och andra subalpina arter, och i rasmarker 70 m

högre upp sådana typiska sydbergsväxter som *Silene rupestris*, *Sedum acre* m. fl.

Det senaste och längst gående angreppet mot termen »sydberg» finner man hos HALDEN (1950), vilken, efter framläggandet av viktiga iakttagelser över kalkförekomster i gråstensbranter och därmed sammanhängande egendomligheter i dessas vegetation, ytterligare utvecklar sina redan 1931 (se ovan) framlagda synpunkter på sydbergsvegetationen som en väsentligen kalkbetingad vegetation. Redan ANDERSSON och BIRGER (1912 s. 62–65) hade starkt framhållit »en rik och jämn vattentillgång under vegetationsperioden» som »ett oeftergifligt lifsvillkor» för sydbergens sydliga flora, utan vilket man i sydbergen icke träffar »någon rikligare växtlighet, utan blott en steril, uttorkad klippmark». Även betydelsen av vattnets karaktär hade klart framhållits av ANDERSSON och BIRGER: »Den stora mängd ständigt ur bergen framsilande vatten, som på de mest gynnade lokalerna står växterna till buds, är sannolikt proportionsvis rikare på näringsämnen än det grundvatten, som står i en vanlig mark; dess utlakningsområde i bergens inre är nämligen mycket större än i det sistnämnda fallet». På grundvalen av egna iakttagelser över kalkförekomster i sydberg skärper HALDEN denna synpunkt till »att bergsegan är nödvändig, men den *måste* vara kalkhaltig. Expositionsriktningen är inom vida gränser betydelselös, så länge man håller sig nedom barrskogens kampzoner mot fjällregionen.» »Det romantiskt klingande» sydbergsbegreppet finner HALDEN »svagt och delvis felaktigt motiverat» och föreslår dess ersättande med »kalkbrant»:

»Övergången från benämningen sydberg till kalkbrant (resp. kalkbrant i sydläge) betingas främst av en helt ny uppfattning av huvudfaktorn i biotopen. Denna övergång medför givetvis, i den mån den skulle komma till större användning, ett hårt slag mot den 'sydbergsromantik', som dirigerat så många och delvis framgångsrika upptäcktsfärder inom vårt lands gränser. Allra minst bör väl en benämning bibehållas enbart av den anledningen, att den som namn betraktad var en 'journalistisk fullträff' för att citera en bortgången forskares karakteristik, om det kan visas, att namnet suggererar till en skev uppfattning om ekologien» (HALDEN 1950 s. 546).

De av HALDEN meddelade iakttagelserna över den ekologiska betydelsen och vanligheten av i gråstensbranter framsipprande vatten av högre kalkhalt, än den i branterna härskande bergarten ger anledning att vänta, stämma väl överens med andra iakttagelser i

liknande sammanhang. I granitfjällen kring Riksgränsen i Torne lappmark (Katteråive och Liutatjårro) har jag ofta funnit lokala kalkväxtförekomster och t. o. m. kalkväxtsamhällen där starka källor bryta fram ur berget. De av källor i Liutatjårros nordsluttning (Liutanjuonje) närda myrarna i Kattervagge strax S om järnvägen innehålla bl. a. medelrikkärr[1] med måttligt eller t. o. m. svagt sur reaktion (pH 5–6 resp. 6–7, jfr Du Rietz 1932 s. 66), i extrema fall med pH upp till 6,4 (kolorimetrisk mätning den 25/8 1939) och stora mattor av *Scorpidium scorpioides*. I nordsluttningen av granitfjället Mälkanrusse i Mjölkvattsfjällen i Jämtland finnas på översilad mark fläckar av för fjället i övrigt främmande kalkvegetation (jfr Rune 1945 s. 5–8, 26 etc.). Och i granitbranter vid Predikstolen i Hågadalen strax S om Uppsala växa mossmattor av *Anomodon viticulosus* och *attenuatus*, *Antitrichia curtipendula*, *Homalothecium sericeum*, *Neckera complanata* m. fl. arter tillhörande den circumneutrofila *Antitrichion*-federationen (v. Krusenstjerna 1945 s. 73–83) och uppenbarligen beroende av mera kalkhaltigt sippervatten än det som kommer de vanliga sura granitbranternas *Plagiothecion*-federation (s. 62–69) till del: i extrakt från dessa mossmattor har jag hösten 1935 konstaterat en i åtskilliga fall circumneutral reaktion (kolorimetriska pH-värden publicerade hos v. Krusenstjerna 1945 s. 238–239). I intet av dessa fall är det tillräckligt utrett, i vilken grad konstaterad kalkverkan beror på kalkhaltigt vatten ur berggrunden, ur kalkhaltiga lösa mineraljordlager eller i det sistnämnda exemplet ur lövskogshumus och lövskogsförna. I intet av fallen torde emellertid den förstnämnda faktorn vara betydelselös.

Haldens kritik mot sydbergsbegreppet och hans förslag att ersätta termen »sydberg» med »kalkbranter» synes icke ha varit utan effekt på svenska botanister (jfr t. ex. Nannfeldt 1953). Likafullt synes mig benämningen »kalkbranter» oantagbar och vilseledande i dess av Halden föreslagna mening. Om denna term drabbas av så stark inflation, att den användes för varje något kalkvattenpåverkad silikatbergartsbrant, vad blir då över för de verkliga kalkbranterna, d. v. s. för branter bildade av ren kalksten eller andra starkt kalciumkarbonatförande bergarter? Sådana äkta kalkbranter

[1] Medelrikkärr (mässig reiches Niedermoor, moderately rich fen, basse tourbière modérément riche) och medelfattigkärr (mässig armes Niedermoor, moderately poor fen, basse tourbière modérément pauvre) föreslås härmed som bättre termer för vad jag förut kallat övergångsrikkärr resp. övergångsfattigkärr (jfr Du Rietz 1949 s. 292–295).

äro alltför vanliga både i fjällen och i låglandets kambrosilur- och urkalkstensområden, och deras vegetation skiljer sig alltför väsentligt från den i HALDENS »kalkbranter», både vad fanerogam- och kryptogamvegetationen beträffar, för att en så stark utvidgning av »kalkbrant»-begreppet skall kunna vara rimlig och rationell. Om namnet »sydberg» »suggererar till en skev uppfattning om ekologien» (HALDEN 1950 s. 546), synes detta i ännu högre grad gälla användningen av ordet »kalkbranter» för en något kalkvattenpåverkad gråstensbrant — och ännu mera om ordet »kalkbrant» användes som allmän beteckning för allt det som förut kallats »sydberg», oavsett om någon kalkvattentillförsel är konstaterad eller endast hypotetiskt antagen.

Med all respekt för kalkfaktorns betydelse för vissa »sydbergsväxter» och för vissa sidor av sydbergens ekologi synes det också innebära en överdrift om man upphöjer den till »huvudfaktorn i biotopen». Icke ens för de kalkgynnade arter, som i sydbergen gå längre mot norr och högre upp i fjällen än på andra biotoper, kan kalkfaktorn bli mer än *en* av huvudfaktorerna, eftersom sydbergens gynnsammare värmeförhållanden och sydexpositionens uppdragande verkan på växtarters och växtsamhällens höjdgränser äro en ofrånkomlig realitet. »I Sikilsdalen virker 'bergrota' og de øverste partier av rasmarkene som et drivhus på stille, klare sommerdager, især på steder hvor klippene er utoverhengende. En kan her plukke store buketter av liljekonvall i juli og modne jordbær i august måned i 1200 m høyde over havet» (NORDHAGEN 1943 s. 546). Om detta är »sydbergsromantik», så är det förvisso en väl motiverad sådan. För sydbergens icke kalkgynnade arter (jfr t. ex. lavarterna *Parmelia conspersa* och *Peltigera scutata* hos DEGELIUS 1945) torde kalkfaktorn inte vara någon huvudfaktor alls. Det synes överhuvudtaget icke möjligt att föra sydbergens ekologiska problem närmare sin lösning genom att skära all sydbergsvegetation över en kam. Vad som nu behövs är dels en differentierad analys av sydbergsvegetationens växtsamhällen sådan som NORDHAGEN (1943 s. 542–567) med stor framgång utfört i Sikilsdalens »urer», och dels ett grundligt specialstudium av varje sydbergsarts ekologi.

Icke minst för detta mera differentierade studium av sydbergsvegetation synes det nödvändigt att använda en entydig och icke vilseledande terminologi. Om man undviker sådana orimligheter som att tala om nordexponerade sydberg, synes ANDERSSONS och BIRGERS term sydberg alltjämt ha en viktig uppgift att fylla som beteckning på berg med »en tvärbrant mot söder exponerad sida»

(Andersson och Birger 1912 s. 52), oberoende av i vilken grad den för sydbergen i allmänhet utmärkande floran är representerad där. Som beteckning på varje berg med tvärbrant sida och en anmärkningsvärd representation i denna av för andra biotoper i trakten främmande sydväxter (Schiöler 1934) eller sydflora (Schiöler 1934, Almquist 1949), oberoende av om tvärbranten är exponerad mot söder eller mot något annat väderstreck, synes termen sydväxtberg (Du Rietz 1953 s. 12) vara att föredraga. Ett sådant bergs tvärbrant kan kallas sydväxtbrant. Ordet brantberg bör kunna användas för varje berg med branter, oberoende av dessas exposition och växtvärld, ordet kalkbrant för varje av kalkbergarter bildad brant, likaledes oberoende av dess exposition och växtvärld. En kalkvattenpåverkad silikatbergartsbrant bör icke kallas kalkbrant.

Uppsala Universitets växtbiologiska institution den 24 februari 1954.

Zusammenfassung.

Südpflanzenberge.

„Sydberg" (Südberge) nannten Andersson und Birger (1912) Berge mit einer südexponierten Steilwand und, besonders im obersten Teil der darunter folgenden Schutthalden, mit einer Ansammlung von südlichen Pflanzenarten, die an anderen Biotopen des betreffenden Gebietes fehlen oder viel seltener sind. Die Ursachen dieser Exklaven südlicher Pflanzenarten, die auch von vielen früheren Verfassern seit Linné und Wahlenberg notiert und besprochen wurden, suchten Andersson und Birger, ebensowie die früheren Verfasser, hauptsächlich in den besonders günstigen Wärmeverhältnissen der Südberge.

In den letzten Jahrzehnten wurde der Ausdruck Südberg vielfach angegriffen. Mehrere Verfasser betonten, dass man „Südbergvegetation" auch in Steilhängen finden konnte, die nicht südexponiert waren, besonders auf kalkreichen Böden. Andersson und Birger wurden einer Überschätzung der ökologischen Bedeutung der Sonnenexposition und des davon bedingten Wärmeüberschusses der Südberge beschuldigt. Man begann sogar, von Südbergsromantik zu sprechen, und man glaubte zeigen zu können, dass der Ausdruck Südberg „zu einer schiefen Auffassung der Ökologie suggerierte" (Halden 1950). Als Ersatz des Ausdruckes Südberg schlug

Grapengiesser (1934) „brantberg" (Steilhangberg) vor, während Halden (1950) den Ausdruck „kalkbrant" (Kalksteilhang) vorzog und dadurch eine „ganz neue Auffassung des Hauptfaktors des Biotops" ausdrücken wollte.

Andererseits betonten und exemplifizierten andere Verfasser (z. B. Schiöler 1934, Nordhagen 1943, Selander 1950) die Bedeutung des Wärmefaktors in den Südbergen und die auffallende Konzentration der „Südpflanzen" zu den steilen und warmen Südhängen.

Der Verfasser gibt einige weitere Beispiele des von Halden betonten und exemplifizierten Auftretens von kalkhaltigem Sickerwasser und davon bedingten Kalkpflanzen und Kalkvegetation in sonst kalkpflanzenfreien Silikatgesteinshängen. Er warnt aber auch vor einer Überschätzung dieses Faktors, vor einer Unterschätzung des Wärmefaktors, und vor einer Verwendung des Ausdrucks „Kalksteilhang" für andere Steilhänge als diejenigen der wirklichen Kalkgesteine.

Der Verfasser schlägt vor, 1) den Ausdruck Südberg als Bezeichnung von Bergen mit einer südexponierten Steilwand zu behalten, unabhängig davon, in welchem Grade die „Südpflanzen" dort vertreten sind, 2) den Ausdruck Südpflanzenberg (Du Rietz 1953 S. 12) für Berge mit wenigstens einer Steilwand und mit einer bemerkenswerten Menge von sonst gebietsfremden Südpflanzen zu verwenden, unabhängig davon, ob die Steilwand gegen Süden oder irgendeine andere Richtung exponiert ist, 3) den Ausdruck Südpflanzensteilhang für einen Steilhang mit einer derartigen Flora zu verwenden.

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RAMARICIUM N. GEN., A CORTICIOID MEMBER OF THE RAMARIA GROUP.

BY

JOHN ERIKSSON.

The lines of natural relationships among the *Basidiomycetes* do not always follow external similarities in the shape of the fructifications. This fact begins to be commonly accepted among mycologists. In several cases it is evident that natural lines cross such artificial families as *Corticiaceae*, *Polyporaceae*, and *Hydnaceae*, which are based primarily on the shape of the fructifications. However, no case of close relations between corticioid and clavarioid fungi seems to have been known earlier.

In recent years, the present author has paid some attention to corticioid fungi inhabiting humus, mosses, herbaceous debris, and similar substrates. While looking for such species, I found twice, in 1949, a fungus which evidently was undescribed. It is a resupinate, which — judged merely from the shape of its fructifications — belongs to *Corticiaceae*. Strangely enough, on closer study, the microscopical details showed it to agree far more with a clavarioid genus, *Ramaria* S. F. Gray em. Donk, than with any known corticioid. I have come to the conclusion that the species found should be placed among clavarioid fungi in spite of its shape, which deviates from all known members of that group. As it can hardly be placed in any one of the known genera, I have had to describe a new one. It is, of course, always very risky to express opinions about the relationships of corticioid fungi, as their organization is very simple and thus gives little hold for judgments. The similarity between my new genus and *Ramaria* is, however, so striking that my supposition of their close relationships seems to be well-founded.

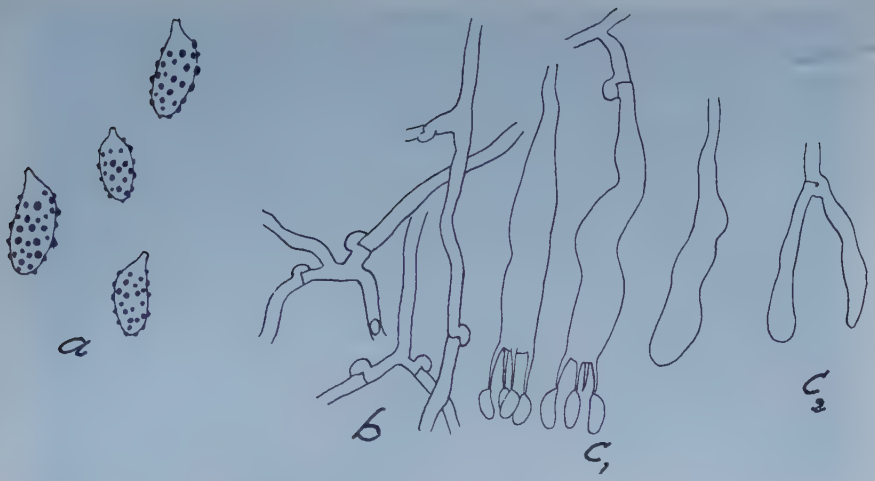

Fig. 1. *Ramaricium occultum* John Erikss. (*a*) Spores, (*b*) Hyphae, (*c*) Basidia. — Spores 1800 ×, other details 900 ×.

Ramaricium John Erikss. n. gen.

(Nomen e '*Ramaria*' et '*Corticium*' compositum.)

Genus *Ramariae* S. F. Gray em. Donk affine sed corticoideum; fructificatio resupinata, laevis, ± carnosa; hymenium basidiis densis compositum; cystidia nulla; hyphae monomiticae, in modum commune ramosae, tenuiter tunicatae; basidiosporae ellipsoideae, apiculo longo, obliquo; paries sporae extus verrucis semiglobosis vel conicis ornata; paries et verrucae ab tincturis "Cotton-Blue" colorabiles.

Genotypus: *Ramaricium occultum* John Erikss.

Close to the clavarioid genus *Ramaria* S. F. Gray em. Donk but corticioid; fructifications resupinate, smooth, rather fleshy; hymenium formed by basidia in a dense palissade; no cystidia; hyphae monomitic, thin-walled, and richly ramified; ramifications normal; basidiospores ellipsoid, with long, oblique apiculus, externally with an ornamentation of hemispherical or conical warts; spore-wall and especially the warts strongly staining in Cotton-Blue.

The new genus agrees with the clavarioid genus *Ramaria* in several respects:

A. Colour. The ochraceous colour of the hymenium reminds one of e.g. *Ramaria abietina* (Fr.) (=*R. Invahlii* [Cott. & Wakef.] Donk).

B. Consistency. The fructifications are fleshy in a manner which is not the common one among the *Corticiaceae*. When dried they are brittle and become easily cracked.

C. The structure of the spores. It is above all the structure of the spores that makes one think of *Ramaria*. Under the microscope

Fig. 2. *Ramaricium occultum* JOHN ERIKSS., growing on the basal parts of *Hylocomium Schreberi*. — $^2/_3$ ×.

they show the same yellowish colour as those of *Ramaria*. Their shape and roughness agree almost completely with e.g. *Ramaria abietina*. The long, oblique apiculus is another characteristic feature that they have in common with *Ramaria*. The ornamentation of the wall consists of warts, which, seen from above, are circular, and from the side, generally hemispherical. In some spores the warts are higher and conical or plug-like. They stain strongly with Cotton-Blue (taking blue colour). Hence they contrast with the spore wall, which also takes the stain but in which the stained layer is much thinner. Sometimes the warts are arranged in longitudinal rows. Such cases are transitional to the spore type of *Ramaria botrytis* (FR.) RICKEN, where the spore ornamentation consists of ridges. I have not been able to find this spore-type, which is an important characteristic of *Ramaria*, in any other corticioid fungus.

Ornamented spores are not rare among *Corticiaceae*, even if smooth spores are by far more common. An investigation of accessible herbarium material with special regard to spore ornamentation, has given the following results:

1. Fam. *Thelephoraceae* s. str. (= *Phylacteriaceae*). The echinu-

late or warty spores are one of the distinguishing features of this family which, in addition to hydnoid and polyporoid genera, also comprises the corticioid *Tomentella* Pat. and *Thelephora* Fr. The spores are medium-sized to large, more or less isodiametric, even or irregular, and brown-walled. They are not stainable by Cotton-Blue or iodine (Melzer's solution). They do not show any similarity to the *Ramaria* type of spores.

2. Gen. *Cristella* Pat. (= *Phlebiella* Karst. s. Rogers). Most of the *Cristellae* (see Donk [1952 p. 485–486], who points out that *Phlebiella* should be replaced by *Cristella*; a similar case of nomenclature [*Lachnellula*] is reported by Nannfeldt & Eriksson [1952 p. 111]) have echinulate spores which, in contrast to those of *Tomentella*, are hyaline. Moreover they are small (generally less than 5 μ), and mostly subglobose. They do not stain with Cotton-Blue or Melzer. In its general features *Ramaricium* reminds one somewhat of a *Cristella* but is distinguished by the colour of the spores and their reaction to Cotton-Blue, and its hyphae are not provided with the ampullae that characterize *Cristella*. Also the shape of the basidia is different. In *Ramaricium* they are long and narrow, almost tube-like, in *Cristella* short, truncate, and rather broad.

3. *Corticium tulasnelloideum* v. H. & L. and related species. They are close to *Cristella*, but differ in having ceraceous fructifications. The shapes of basidia and of spores, as well as the spore ornamentation and the spore reaction, are the same.

4. Sect. *Athele* of *Corticium*. Jackson (1950 p. 525–534) demonstrated non-amyloid spore ornamentation in the *Peniophora rimicola* group. In *P. pruinosa* (Pat.) Jacks., the only representative of the group which I have studied, there stands out (in Melzer) a faint but obvious structure, consisting of low warts. The spore wall and the warts do not stain with Cotton-Blue and the ornamentation is hardly visible in lactic-blue (lactophenol + Cotton-Blue). In some spores the warts show a tendency to be arranged in rows, so the structure approaches that of *Peniophora pulverulenta* (Litsch.) Jacks., where the ornamentation is reported to consist of longitudinal ridges. There is no similarity to the *Ramaria* type of spores.

5. Gen. *Gloeocystidiellum* Donk (*Corticiaceae*). Type of this genus is *Corticium porosum* B. & C., which species has ellipsoid, hyaline spores, the walls of which are provided with small aculei or warts. Besides in colour and shape, they differ from the spores of *Ramaricium* by the fact that they are amyloid. Globose, conspicuously

echinulate and amyloid spores occur in *Corticium granulosum* Wakef. (= *Gloeocystidium furfuraceum* [Bres.] v. H. & L.), which also belongs here. The aculei are relatively large and densely situated, conical and consequently appear round when seen from above. *Peniophora convolvens* (Karst.) Karst. is to be placed in the same genus. Its spores remind one of those of *Corticium porosum* but are larger and more conspicuously echinulate. As in *Ramaricium* the aculei are round from above and sometimes arranged in rows. In *Gloeocystidium Karstenii* Bourd. & Galz. the spores appear to be smooth at low magnification but on higher magnification and staining with iodine (Melzer) they prove to be provided with low and sparse, but distinct warts. In *Corticium lividocoeruleum* Karst. a faint roughness can be seen in some spores but most of them are, as far as I can see, smooth. *Corticium luridum* Bres. and *C. ochraceum* (Fr. ex Fr.) Fr. seem to have smooth spores.

All species of *Gloeocystidiellum* differ from *Ramaricium* in having amyloid spore membranes, as well as in size and shape of the spores. All *Gloeocystidiella* have further cystidial organs of some kind.

6. *Peniophora heterogenea* Bourd. & Galz. As in the previous genus the spores are amyloid and possess densely situated, strongly amyloid warts. In my opinion this species ought to be referred to *Gloeocystidiellum*.

7. Gen. *Aleurodiscus* (*Corticiaceae*). In the amyloid-spored *Aleurodisci*, which are closely related to the previous genus, there are spore ornamentations resembling those of *Gloeocystidiellum*, but as the spores are larger, they are easier to study in details. In *A. aurantius* (Pers.) Schroet. the spore wall has densely situated, strongly amyloid warts, or conical aculei. In *A. amorphus* (Pers. ex Fr.) Rab. the aculei are larger, reaching 2 -3 μ in length, straight or somewhat curved, somewhat tapering, and as a rule abruptly truncate. The aculei are born on a thin, outer layer of the wall, which easily flakes off from a thicker inner layer. Contrary to the aculei and the outer layer, the inner layer seems to contain no amyloid substance. *A. disciformis* (DC. ex Fr.) Pat. has similar spores but the aculei are lower, rounded when seen in profile, and rather irregular, sometimes confluent from above. *A. acerinus* (Pers. ex Fr.) v. H. & L. has smooth spores with weak and irregular amyloidity. The other Scandinavian species with amyloid spores (*A. fennicus* Laur. = *A. Vleugelii* Litsch., and *A. lapponicus* Litsch.) have smooth spores with continuous amyloidity. All amyloid-spored *Aleurodisci* have

regularly ellipsoid (prolonged in *A. acerinus*) and usually large spores. They form a very natural group with relations to *Gloeocystidiellum*. Not only the nature of the spores, but also the shape of the basidia (which places e.g. *Corticium luridum* and *Aleurodiscus lapponicus* close to each other), and the presence of *Aleurodiscus*-like acanthophyses in *Corticium lividocoeruleum*, support this relationship.

The subgenus *Lyomyces* (KARST.) PILÁT, which comprises a small, natural group of species with smooth, non-amyloid spores, perhaps should be regarded as a separate genus.

8. *Peniophora Abietis* BOURD. & GALZ. This strange species has globose spores, which on their surfaces bear small aculei, arranged in groups, each group containing about 20 aculei. Between the groups the spore-wall is smooth. This arrangement of the aculei causes the spores to appear 6- or 8-sided when studied at low magnification. The aculei stain dark blue with Cotton-Blue. In this respect this species agrees with *Ramaricium* but in all other respects it differs so much that there is no reason to suggest any relationship. In Melzer the spores become stained brown as does the basal part of the cystidia. The wall of the cystidia is many-layered and the innermost layer, which is much thicker in the basal part, turns brown in iodine. The spore-wall seems to be 2-layered. The thinner, outer layer stains with Cotton-Blue in the same way as the aculei.

9. *Gloeocystidium analogum* (BOURD. & GALZ.). The spore ornamentation is seen as a sinuosity in the contour of the spore, but also in this species the spores seem eventually to get more or less distinct warts, round from above and sometimes convex from the side. There is no reaction to Cotton-Blue or Melzer.

10. *Corticium punctulatum* CKE. The spore wall is ornamented by densely situated, rather short and blunt aculei. It is somewhat thickened (probably 2-layered) and not stainable by Cotton-Blue or Melzer. The spore type agrees with that of *Gl. analogum* to which it is certainly closely related. *Peniophora sphaerospora* v. H. & L. which, according to ROGERS and JACKSON (1943 p. 321), is identical with *C. punctulatum*, has smaller, globose or subglobose spores (in *C. punctulatum* they are ellipsoid) with smooth walls. It seems to be a separate but evidently closely related species.

11. *Corticium mutabile* BRES. According to the original description, and to BOURDOT & GALZIN (1928 p. 195), this species has echinulate spores. However, this seems to be erroneous, as the spores are smooth in the type material (in Naturhistoriska Riksmuseet, Stockholm).

Moreover, I have collected the species several times myself and have always noted only smooth spores.

12. Gen. *Vararia* (*Corticiaceae*). The spores vary both as to shape and to amyloidity. The majority of the species have globose, ornamented, and amyloid spores: *V. effuscata* (Cke & Ell.) Rogers & Jacks. shows a spore ornamentation of extended, irregular ridges which form curved lines of amyloid substance round the spore. *V. dura* (Bourd. & Galz.) has spores resembling those of the previous species but their ornamentation is not so conspicuous. *V. peniophoroides* (Burt) Rogers & Jacks. agrees as to the spores with *V. effuscata* but their ornamentation is more prominent. It consists of rounded or irregular, large and closely situated amyloid knobs which are often united by fine, sinuous ridges into a conspicuous and characteristic structure. *V. pallescens* (Schw.) Rogers & Jacks. has spores as in the previous species, provided with an ornamentation of large knobs and sinuous ridges. Sometimes there is a tendency of circular arrangement of the ridges. Around the apiculus the spore wall is smooth. *V. granulosa* (Pers. ex Fr.) Laurila shows an ornamentation of rounded, amyloid warts which sometimes coalesce into ridges.

The following species have non-amyloid or partly amyloid spores, which differ also in shape from those of the previous species, all of which have globose spores:

V. investiens (Schw.) Karst. The spores are fusiform, thus differing considerably from the previous group. A small part of the spore membrane adjoining the apiculus shows amyloid reaction. The amyloid part of the spore is empty of plasm and looks generally like a little, shrunk appendix to the spore. The rest of the membrane seems to be smooth or possibly very faintly punctate.

Vararia sp. (leg. Hubert. *Aleurodiscus Weirii* Burt, det. Burt. Litschauer: "Vielleicht *Asterostromella gallica* Bourd. & Galz."). Only a few spores were seen. They are ellipsoid and like the spores of *V. investiens* only partially amyloid. The amyloid substance forms a patch, ring or U-shaped figure on the ventral side of the spore immediately adjoining the apiculus. The amyloidity is most easily seen in old spores and especially in empty spore membranes.

Vararia sp. (B. & J. Eriksson n. 3857). The spores are ellipsoid and partially amyloid. The amyloid substance forms irregular, unevenly distributed patches on the spore membranes, best studied in old spores.

V. ochroleuca (Bourd. & Galz.). In the scarce material studied, no amyloidity could be seen. The spores are small, subglobose.

13. Gen. *Asterostroma*. This genus is dominated by one distinct spore type, all species but one (*A. fulvum*) having amyloid, globose spores. Only one of these amyloid species (*A. laxum* Bres.) has smooth spores. In the majority of species they are seemingly echinulate but the spines are not, as usually, formed exclusively by the wall. They are, on the contrary, tube-like projections of the spore, consisting consequently of both wall and spore contents. The following species investigated have spores of this kind: *A. andinum* Pat., *apalum* (B. & Br.) Massee, *cervicolor* (B. & C.) Massee, *muscicolum* (Boc.) Massee, *ochroleucum* Pat., and *roseum* Bres. In *A. cellare* P. Henn. no spores have been found.

A. fulvum Romell has smooth, non-amyloid spores. Its relations to the earlier species seem from this stand-point also very dubious.

Asterodon ferruginosus Pat. has smooth, non-amyloid spores. In this, as in other respects, it is much more close to *Hymenochaete* Lév. than to *Asterostroma*.

14. Gen. *Pellicularia* (*Corticiaceae*). There are some species with echinulate or asperulate spores, but none of them shows any relation to *Ramaricium*.

Spores with ornamentations occur among clavarioid fungi, besides in *Ramaria* in e.g.:

(i). *Clavulinopsis helvola* (Fr.) Corner (= *Clavaria inaequalis* Müll. ex Fr.). The spores are subglobose and provided with tube-like papillae. The spore-membrane does not react to Cotton-Blue or iodine (Melzer). There is certainly no close relation between this species and *Ramaricium*.

(ii). *Ramariopsis* ("Fr.") Donk (= *Clavaria Krombholzii* Fr.). The spores are subglobose, echinulate, non-amyloid, and do not react to Cotton-Blue. This species also seems to be not related to *Ramaricium*.

Among the species mentioned above there is only one, *Peniophora Abietis*, that shows the same reaction as *Ramaricium* to Cotton-Blue. This species differs, however, in other respects. It is thus only *Ramaricium* that shows a spore morphology comparable to that of *Ramaria*.

D. Ecology. *Ramaricium* agrees ecologically with species of *Ramaria*, many of which occur among *Hylocomia* in coniferous

forests. The mycelia of *Ramaria dendroides* (Fr.) and related species form floccose felts in the bottom of the moss carpets in much the same way as do the mycelia of *Ramaricium*.

The new genus comprises only one species, its genotype:

Ramaricium occultum John Erikss. n. sp. Fructificatio e mycelio albo irregulariter effusa; hymenium pallide ochraceum (Ridgway: Pinkish Buff–Pale ochraceous-Salmon); hyphae basales rectae et parallelae, 1.5–3.5 μ; hyphae subhymeniales sinuosae et dense ramosae, 1.5–2.5 μ; basidia 38–43 × 5–7 μ, sterigmata 4; basidiosporae pallide luteolae, asperulatae, tunicis incrassatis, 5.5–8.3 × 3.3–3.9 μ.

Occulte in parte basali *Hylocomiorum* crescens.

Fig. 1–2.

Fructification totally resupinate, irregularly effused, formed from a white mycelium which penetrates the substrate; hymenium smooth, pale ochraceous (Ridgway: Pinkish Buff-Pale ochraceous-Salmon); hyphae thin-walled, 1.5–3.5 μ in diam., ramified in the usual manner, mostly from the fibulae or opposite to them but often also between the septa; those of the subhymenium densely ramified and interwoven; the basal hyphae rather straight and parallel; basidia tube-like, tapering towards the base, 38–43 × 5–7 μ, with 4 sterigmata; basidiospores pale yellowish (under the microscope), with asperulate and somewhat thickened wall, 5.5–8.3 × 3.3–3.9 μ; the aculei of the spore wall round from above, from the side semiglobose or conical; spore membrane (at least the exterior layer) and the aculei stain strongly in Cotton-Blue.

R. occultum was collected only twice. Both times it was found in the bottom layer of fresh *Hylocomium* carpets in coniferous forests, one collection in *Hylocomium splendens* under *Picea* and the other in *Hylocomium Schreberi* under *Juniperus communis*. It grew completely hidden why the collections were made only by chance. As it easily escapes discovery, it must not of course be quite as rare as may seem from the two collections. Ecologically it is a member of a group of species, not closely related, which take their nourishment preferably from the dying bases of the moss carpets. Another species of this group, *Sistotrema commune* John Erikss., has been treated earlier by the author (1949 p. 310–315).

Specimens:

Uppland: Djurö parish, Runmarö, between Södersunda and Skogsberga ödetorp, in *Hylocomium Schreberi* under a dead *Juniperus communis*, 3.XI. 1949, G. Haglund & J. Eriksson (Typus). Älvkarleby parish, Brämsand, in the bases of *Hylocomium splendens*, 20.XI. 1949, J. Eriksson n. 4183. — Both specimens belong to the collections of Uppsala Botaniska Museum.

Discussion.

The close relationship between *Ramaria* and *Ramaricium* is very obvious to the author. Evidently there may exist closer relations between a corticioid and a clavarioid species than between two clavarioid fungi from different genera. It can be assumed that clavarioid fructifications may have developed from corticioid ones, just as well as polyporoid and hydnoid fructifications may have arisen in this way. The family *Clavariaceae* in common sense is probably not monophyletic, just as little as *Polyporaceae* and *Hydnaceae* are so. The new genus points out one possible line of development from *Corticiaceae* to *Clavariaceae*, but it is probable that there are several, just as well as there are several lines passing from *Corticiaceae* to *Hydnaceae* and *Polyporaceae*.

In a particular case as the one discussed in this paper, one cannot be quite sure that the species has not arisen as a result of reduction, viz. from *Ramaria*. It is conceivable that this is the case, but the existence of the new species no doubt points to one way which may have been followed by evolution, and in mycology it is difficult to reach much further.

When discussing *Ramaria* and *Ramaricium* it is necessary to take into consideration two other fungi, *Clavaria Himantia* (Schw.) Fr. and *C. Bourdotii* Bres. Both have resupinate, hydnoid fructifications and they look consequently like members of *Hydnaceae*. According to Bourdot & Galzin there are some characteristics in the exterior shape of the fructifications which remind one of *Clavariaceae*. In their interpretation, every aculeus corresponds to a clavarioid fructification. This opinion is of course not very well-founded, but the reason why they wished to maintain such a correspondence was certainly that in the microscopical structure of the fungus they recognized *Clavariaceae*, viz. the genus *Ramaria*. Corner (1950 p. 265) rejects the outer resemblance with *Clavariaceae* and refers both species to *Hydnaceae*. However, this does not seem to be necessary. As has already been said, the exterior of the fructification matters very little and from the shape it is hardly possible to decide whether these debated species belong to *Clavariaceae* or *Hydnaceae*. The anatomical structure, preferably of the spores, seems to give better support. The spores show the same characteristic structure as those of *Ramaria* and *Ramaricium*. The agreement is rather complete: the spores are yellowish, the shape is the same as in *Ramaria*, and the membrane is ornamented with warts or aculei, which stain strongly

in Cotton-Blue. I have noted this spore structure in no other hydnoid fungus. According to my opinion this agreement is a sign of close relationship, and therefore these two species are to be placed near *Ramaria* and *Ramaricium* as a genus of their own. To these two genera with clavarioid and corticioid fructifications, respectively, there is consequently added a small genus with hydnoid fructifications. For *Clavaria Bourdotii* there exists a valid generic name, viz. *Kavinia* PILÁT (1938), which was described as a new genus, for *Caldisiella sajanensis* PILÁT (1936 p. 329, t. 5: 2, fig. 32). *C. sajanensis* is identical with *Clavaria Bourdotii* BRES. (type in Herb. Praha studied!).

Summary.

A new genus with a new species, *Ramaricium occultum* JOHN ERIKSS., is described. Arguments are reported for the location of the new species, which has corticioid fructifications, close to the clavarioid genus *Ramaria*. The systematical place of *Clavaria Himantia* and *C. Bourdotii* is discussed.

I owe my deep thanks to Professor J. A. NANNFELDT. In this particular case, I have profited mainly from his interest in stain reactions. He has also critically studied the manuscript.

Institute of Systematic Botany, University of Uppsala, January 1954.

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TAXONOMIC STUDIES IN AFRO-ALPINE CARYOPHYLLACEAE.

BY

OLOV HEDBERG.

Contents.

	Page
Introduction	199
Silene	200
Stellaria	201
Sagina	202
Survey of afro-alpine species	208
References	209

Introduction.

The present author has for some time been occupied with a revision of the flora of the alpine belt on the high East African mountains[1] (Hedberg 1951 p. 187), the results of which it is hoped to publish within a couple of years. One of the families so far treated is *Caryophyllaceae*, and since a treatment of this family is now being prepared at Kew for the *Flora of Tropical East Africa* it was deemed desirable to publish my results on this group as soon as possible.

Most of my taxonomic studies have been carried out at the Kew Herbarium, and supplementary work has been done at British Museum (Natural History). Material on loan has been obtained from Paris (Musée d'Histoire Naturelle), Firenze (University Herbarium), and Nairobi (East African Herbarium). My studies in England have been supported by a scholarship from the British Council and by grants from "Västerås Stads Kulturfond" and the Swedish Natural

[1] The term "afro-alpine" was coined by Hauman (1933 p. 906) for the peculiar flora characteristic of the alpine belt of these mountains.

Science Research Council. To all these institutions I tender my sincere thanks. I am also obliged to Mr. J. Lewis, Kew, for critical reading of the English text and to Mr. N. Y. Sandwith, Kew, for correcting the Latin diagnoses.

Of the four caryophyllaceous genera reaching the alpine belt in East Africa one — *Cerastium* — has recently been revised by Möschl (1951), and consequently I shall deal here only with the other three: *Silene*, *Stellaria*, and *Sagina*. The present paper concerns only the taxonomy of the relevant species; their ecology and distribution will be treated in a later communication.

Silene.

There seems to be no possibility of keeping apart the two species *Silene burchellii* Otth (1824), described from South Africa, and *S. chirensis* A. Rich. (1847), from Ethiopia[1]; when describing the latter Richard apparently had no knowledge of the former. They were united under the former name by Oliver (1868 p. 139; see also Bolus in Williams 1896 p. 76 and in Burtt Davy 1924 p. 223), and this name has also been most often applied to East African specimens (Engler 1912 p. 382, and 1915 p. 164; Weimarck in Norlindh & Weimarck 1934 p. 92; Balle 1951 p. 150). Engler described another species of the same genus from East Africa, *S. meruensis*, distinguished mainly by dense pubescence, wider calyx tube, and longer coronal scales (Engler 1912 p. 382; 1915 p. 165). The latter species was reduced by Weimarck (l.c.) to a variety of *S. burchellii*; he considered the width of the calyx as the only distinctive criterion between the two. This feature also seems to be very variable, however, and specimens with wide calyx occur not only on Mt. Meru and in Rhodesia, but also on Kilimanjaro, Elgon, Mt. Kineti, and in Ethiopia. Different populations may have different *averages* in this respect, but their variation ranges are largely overlapping and it seems impossible to maintain *S. meruensis* even as a variety.

The type specimen of *Silene burchellii* belongs to a maritime strain with rather procumbent stems and broad basal leaves (Burtt Davy 1924 p. 228), whereas the inland material, which was referred by Sonder (1860 p. 128) and Burtt Davy (l.c.) to the varieties "*angustifolia*" and "*latifolia*", has normally more erect stems and

[1] This is now the official name of the country formerly known as Abyssinia.

narrower basal leaves. The phenotypical plasticity of this species seems to be high since specimens grown at Uppsala from seeds of a collection from Kilimanjaro (Hedberg 1291 a) show much broader leaves with less pubescence than in the parent plant (Hedberg 1291); the internode length also varies less on the cultivated specimens. It is thus very difficult to judge how much of the apparent differences between any two herbarium specimens are genotypically conditioned, and how much is due to environmental influence alone. In my opinion it is not possible to prepare a satisfactory subdivision of this species without experimental work.

Stellaria.

The name "*Stellaria brauniana* Fenzl" (ms.) was first published by Schweinfurth (1867 p. 60) for a species, but since he had not seen sufficient material he gave no description of the taxon. Engler (1895 p. 176) seems to have published the first description of it, but regarded it as a variety of *Stellaria media* (L.) Vill. It was later promoted to an independent species again by Robyns (1948 p. 158), who considered it to be well distinguished from *S. media* by having always tetrameric flowers with 2 styles. Another good criterion is found in the leaves: in *S. brauniana* all leaves (including the bracts) are normally cordate, with long petioles, whereas in *S. media* the upper leaves are usually sessile and broadly elliptic in outline. Furthermore the capsule in *S. brauniana* is normally shorter than the calyx, whereas in *S. media* it is usually longer than the calyx. In fact, the distinction between these two species is quite good.

The relations between *S. brauniana* and the Madagascan *S. emirnensis* Danguy are less clear, however (Danguy 1915 p. 157; Per-

Table I. Main differences between *Stellaria brauniana* (Engl.) Robyns and *S. emirnensis* Danguy.

	Stellaria brauniana	*Stellaria emirnensis*
Corolla	absent	present, very small
Leaf base	± cordate	± truncate
Seed papillae	conical, *c.* 0.05 mm long	cylindrical, *c.* 0.1–0.15 mm long
Number of stamens	2–3(–4)	3–4
Capsule length	shorter than calyx	about equalling calyx or slightly longer

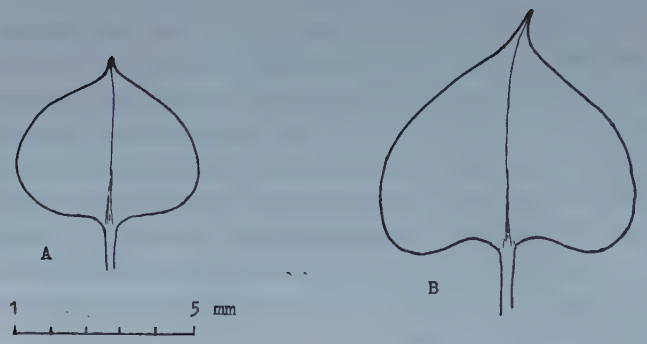

Fig. 1. Typical leaf shape in *Stellaria emirnensis* Danguy (A, drawn from the holotype, Viguier & Humbert 1845, P) and *S. brauniana* (Engl.) Robyns (B, drawn from Purseglove 2933, K).

rier de la Bâthie 1950 p. 7 and Fig. I: 5–10). I had the opportunity of seeing three specimens of the latter, including the holotype, and of comparing them with representative material of *S. brauniana* at Kew. The main differences between the two are summarized in Table I (see also Fig. 1). All the differences are rather minute, and it might perhaps be justifiable to regard them as only subspecifically distinct. But the available material of *S. emirnensis* is yet too small for a conclusive treatment, and thus it seems best at present to maintain *S. brauniana* as a separate species.

Sagina.

Two species of *Sagina* have been described from the mountains of Tropical Africa: *S. abyssinica* Hochst. ex A. Richard (1847 p. 47), and *S. brachysepala* Chiovenda (1911 p. 52). All *Sagina* material from the mountains of equatorial Africa has hitherto been referred to the former species. This material displays a considerable variation in many features, apparently largely due to environmental influence. Thus, specimens from the alpine belt often form dense cushions, whereas specimens from lower level usually have lax, trailing stems. The size of the corolla is quite variable; many high-level specimens are entirely apetalous. During the Swedish East Africa Expedition of 1948 the present author collected rich *Sagina* material, and afterwards succeeded in raising living plants from seeds of three different collections. When the somatic chromosome number was counted on these, two different numbers were obtained, which initiated a thorough morphological study of all herbarium material available. The specimens from equatorial East Africa were

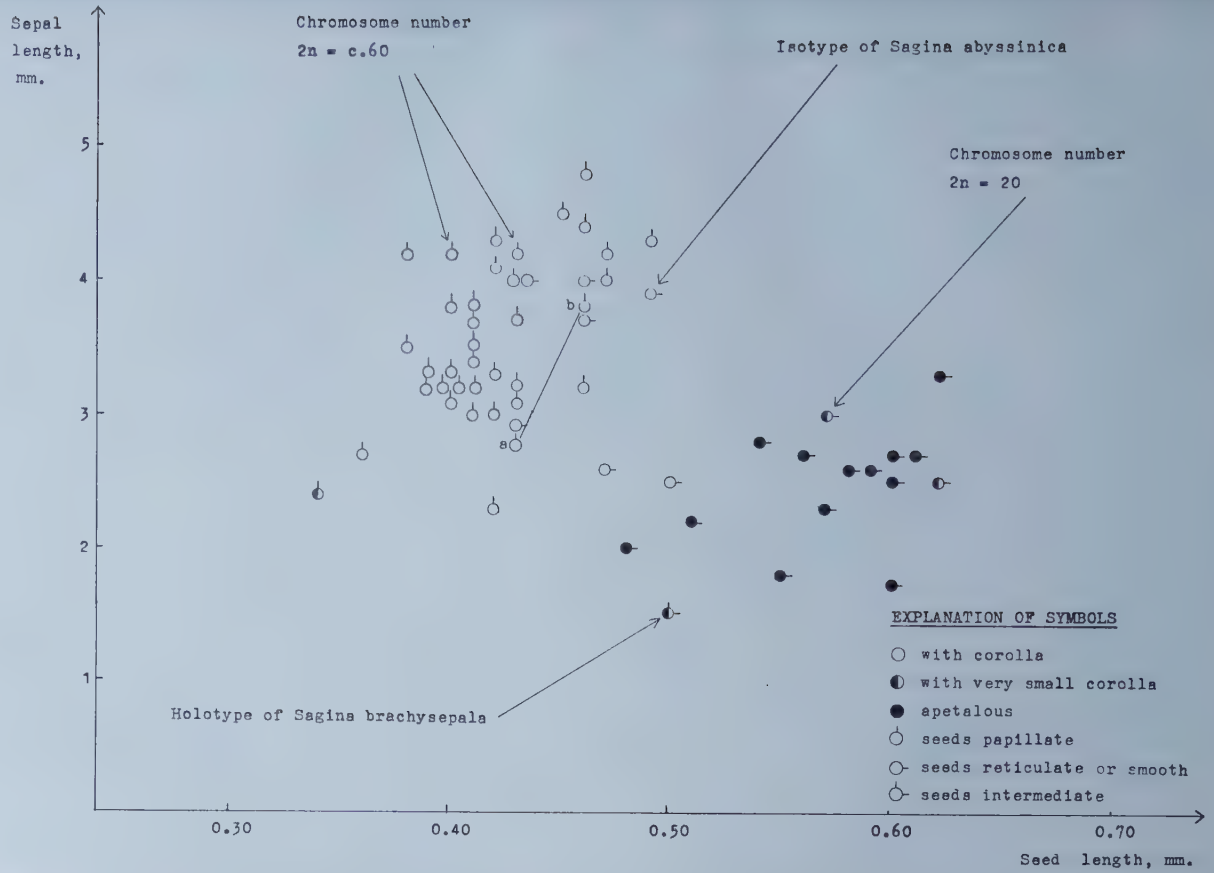

Fig 2. Pictorialized scatter diagram, showing correlated variation in sepal length, seed texture, and size of corolla in specimens of *Sagina* from Tropical Africa (cf. Table II). The dots united with a line and marked *a* and *b* refer to the same strain; *a* was measured on cultivated specimens grown at Kew from seeds of *b*.

Table II. Measurements on African *Saginae.*

A) Origin of collection. B) Calyx length. This was measured on 3 different flowers to the nearest $^1/_{10}$ of a mm. C) Seed length, measured on 10 seeds of each collection to the nearest $^1/_{40}$ of a mm. For B and C are only given average values and range of variation. D) Texture of seed surface: p = papillate, sp = intermediate, s = more or less smooth. E) Corolla: + + = corolla present, of medium size; + = corolla present, very small; 0 = corolla absent.

A	B (mm)	C (mm)	D	E
S. abyssinica ssp. ***abyssinica***				
Ethiopia, Demerki, SCHIMPER II: 1148 (K, isotype) ..	3.9 (3.5–4.1)	0.49 (0.45–0.53)	s	+ +
,, , ,, , ,, ,, (FI, ,,) ..	2.9 (2.5–3.2)	0.43 (0.40–0.48)	s	+ +
,, , Mt. Selchi, PICHI-SERMOLLI 2587 (FI)	3.7 (3.3–3.9)	0.46 (0.45–0.50)	s	+ +
,, , ,, , ,, 2597 (FI)	2.5 (2.3–2.7)	0.50 (0.43–0.55)	s	+ +
,, , ,, , ,, 2594 (FI)	2.6 (2.0–2.9)	0.47 (0.45–0.50)	s	+ +
,, , ,, , ,, 2595 (FI)	4.0 (3.0–4.5)	0.43 (0.40–0.45)	s	+ +
,, , Mt. Buahit, ,, 2590 (FI)	4.0 (3.7–4.5)	0.46 (0.43–0.50)	s	+ +
S. abyssinica ssp. ***aequinoctialis***				
Fernando Po, 2 600 m, Febr. 1861, MANN (K)	3.7 (3.5–3.9)	0.43 (0.38–0.50)	p	+ +
,, , Guinea 2836 (K).....	4.0 (3.8–4.2)	0.47 (0.45–0.50)	p	+ +
Cameroons Mt., 2 750–3 050 m, MANN 2027 (K)	3.7 (3.2–4.0)	0.41 (0.35–0.45)	p	+ +
,, , 3 300 m, MILDBRAED 10899 (K).....	3.4 (3.3–3.5)	0.41 (0.35–0.45)	p	+ +
,, , 3 350 m, MANN 1288 (K).....	3.3 (3.2 3.5)	0.39 (0.35–0.40)	p	+ +
,, , 3 350 m, KEAY 28614 (K).....	3.2 (3.0–3.3)	0.40 (0.35–0.43)	p	+ +
,, , 3 650 m, MAITLAND 1254 (K).....	3.5 (3.2–3.7)	0.38 (0.35–0.40)	p	+ +
Belg. Congo, Mikeno, 3 250 m, HUMBERT 8036 (K) ..	3.1 (2.8–3.5)	0.40 (0.38–0.43)	p	+ +
Uganda, Mgahinga, 2 750 m, PURSEGLOVE 3703 (K)..	3.8 (3.7 4.0)	0.46 (0.45–0.48)	p	+ +
Specimen grown at Kew from seeds of prec.....	2.8 (2.8–2.9)	0.43 (0.43–0.45)	p	+ +
Uganda, Muhavura, 2 450 m, ROGERS & GARDNER 332 (K).....	3.8 (3.7–4.0)	0.40 (0.38–0.43)	p	+ +
Uganda, Muhavura, 2 750 m, EGGELING 988 (K)	4.1 (4.0–4.2)	0.42 (0.38–0.45)	p	+ +
,, , ,, , 3 050 m, WILLIAMS B 5062 (K)..	4.5 (4.3–4.7)	0.45 (0.43–0.48)	p	+ +
,, , ,, , 3 350 m, HEDBERG 2170 (UPS) .	4.8 (4.4–5.3)	0.46 (0.40–0.50)	p	+ +
,, , ,, , 3 500 m, PURSEGLOVE 779 (K) ..	3.8 (3.7–3.9)	0.41 (0.38–0.43)	p	+ +
,, , ,, , 3 500 m, TAYLOR 1735 (BM)....	3.2 (2.8–3.5)	0.43 (0.40–0.45)	p	+ +
,, , Behungi, 2 300 m, THOMAS 1054 (K).....	3.3 (3.3–3.4)	0.40 (0.35–0.43)	p	+ +
,, , Kanaba Gap, 2 450 m, CHANDLER & HANCOCK 2624 (K).....	3.5 (3.4–3.6)	0.41 (0.38–0.45)	p	+ +
Uganda, Kanaba Gap, 2 450 m, PURSEGLOVE 2058 (K)	3.2 (2.7–3.6)	0.46 (0.40–0.50)	p	+ +
,, , Mt. Moroto, 2 900 m, EGGELING 2895 (K) ..	3.2 (3.0–3.5)	0.39 (0.35–0.40)	p	+ +
,, , Imatong Mts, Kippia, 2 450 m, THOMAS 1809(K)	4.2 (3.7–5.0)	0.38 (0.33–0.40)	p	+ +
,, , Elgon, top camp, TOTHILL 2435 (K)	4.0 (3.8–4.2)	0.43 (0.40–0.45)	p	+ +
,, , ,, , 3 950 m, DUMMER 3303 (K)	4.4 (4.3–4.5)	0.46 (0.43–0.50)	p	+ +
Kenya, Elgon, 3 450 m, HEDBERG 220 (UPS)	4.2 (4.0–4.3)	0.43 (0.40–0.45)	p	+ +

A	B (mm)	C (mm)	D	E
Kenya, Elgon, 3 700 m, HEDBERG 870 (UPS)	4.3 (3.6–4.8)	0.42 (0.38–0.45)	p	+ +
„ , „ , 3 500 m, TAYLOR 3651 (BM)	4.2 (4.0–4.4)	0.47 (0.40–0.53)	p	+ +
„ , „ , 3 950 m, TAYLOR 3580 (BM)	4.3 (4.2–4.3)	0.49 (0.45–0.53)	p	+ +
„ , Aberdare, ALBRECHTSEN 2729 (K)	3.2 (3.0–3.3)	0.40 (0.38–0.43)	p	+ +
„ , „ , Kinangop, 2 700 m, CHANDLER 2326 (K)	3.0 (2.4–3.5)	0.41 (0.38–0.43)	p	+ +
Kenya, Aberdare, 3 200 m, TAYLOR 1399 (BM)	2.7 (2.5–2.8)	0.36 (0.35–0.38)	p	+ +
„ , Mt. Kenya? (with ROGERS 455) (K)	3.1 (2.9–3.2)	0.43 (0.40–0.45)	p	+ +
"East equatorial Africa", 1888, W. E. TAYLOR (BM)	2.4 (2.4–2.5)	0.34 (0.30–0.35)	p	+
Tanganyika, Kilimanjaro, 3500 m, GREENWAY 3922 (K)	3.3 (3.0–3.7)	0.42 (0.40–0.43)	p	+ +
„ , „ , 3 800 m, VOLKENS 1195 (K)	3.2 (3.1–3.5)	0.41 (0.38–0.45)	p	+ +
„ , „ , 3 800 m, SCHLIEBEN 4434 a (BM)	3.0 (2.9–3.2)	0.42 (0.40–0.45)	p	+ +
Tanganyika, Kilimanjaro, 3 800 m, SCHLIEBEN 4434 b (BM)	2.3 (2.0–2.6)	0.42 (0.40–0.43)	p	+ +
Tanganyika, Kilimanjaro, 4 130 m, HEDBERG 1412 (UPS)	4.2 (3.8–4.7)	0.40 (0.38–0.43)	p	+ +
S. brachysepala				
Ethiopia, Amhara-Simien, Debarek, Chiovenda 2938 (FI)	1.5 (1.4–1.6)	0.50 (0.48–0.53)	sp	(+)
S. afroalpina				
Ethiopia, Mt. Bachit, 4 250 m, SCHIMPER 218 1851 (FI)	2.8 (2.6–3.1)	0.54 (0.50–0.60)	s	0
„ , Mt. Degien, 4 350–4 620 m, PICHI-SERMOLLI 2094 (FI)	1.7 (1.6–1.8)	0.60 (0.58–0.63)	s	0
Uganda, Ruwenzori, 3 450 m, HEDBERG 654 (UPS)	2.3 (2.2–2.3)	0.57 (0.53–0.60)	s	0
„ , „ , 3 800 m, FISHLOCK & HANCOCK 97 (K)	2.6 (2.5–2.7)	0.59 (0.55–0.63)	s	0
Uganda, Ruwenzori, 3900–4500 m, HUMPHREYS 549 (K)	2.7 (2.5–3.0)	0.56 (0.48–0.63)	s	0
„ , „ , 3 950 m, HUMPHREYS 1211 (BM)	2.6 (2.3–2.8)	0.58 (0.55–0.60)	s	0
„ , „ , 4 050 m, HEDBERG 410 (UPS)	2.5 (2.5–2.6)	0.60 (0.55–0.65)	s	0
„ , Elgon, 3 200 m, FORBES 268 (K)	2.0 (1.9–2.1)	0.48 (0.45–0.50)	s	0
Kenya, Elgon, 4 100–4 250 m, TAYLOR 3697 (BM)	2.7 (2.5–2.8)	0.61 (0.53–0.65)	s	0
„ , Aberdare, 3 900 m, HEDBERG 1542 (UPS)	2.7 (2.5–3.0)	0.60 (0.58–0.63)	sp	0
„ , „ , TAYLOR 1506 (BM)	3.3 (2.9–3.6)	0.62 (0.55–0.65)	s	0
„ , Mt. Kenya, ROGERS 455 (K)	2.2 (2.0–2.3)	0.51 (0.48–0.55)	s	0
„ , „ , 4 200 m, HEDBERG 1704 (UPS)	1.8 (1.6–2.0)	0.55 (0.50–0.63)	s	0
„ , „ , 4 250 m, LE PELLEY, B 3440 (K)	2.5 (2.3–2.7)	0.62 (0.55–0.68)	s	+
Tanganyika, Kilimanjaro, 4 600 m, HEDBERG 1250 (UPS)	3.0 (2.8–3.2)	0.57 (0.50–0.63)	s	+

Table III. Survey of main differences between the afro-montane *Sagina* species.

Character	*S. abyssinica* ssp. *abyssinica*	*S. abyssinica* ssp. *aequinoctialis*	*S. brachysepala*	*S. afroalpina*
Aver. seed length	0.43–0.50 mm	0.34–0.49 mm	0.50 mm	0.48–0.62 mm
Texture of seed surface	reticulate or almost smooth	more or less distinctly papillate	vaguely papillate	reticulate or almost smooth
Corolla	small, consisting of 5 petals		rudimentary, one petal only	(rudimentary or) absent
Aver. calyx length	2.5–4.0 mm	2.3–4.8 mm	1.5 mm	1.7–3.3 mm
Sepal shape	ovate-lanceolate, apex ± hooded		circular or elliptic, apex hooded	elliptic-ovate, apex hooded
Capsule	not protruding		protruding	not protruding
Peduncles	slender		slender	stout
Habit	lax, with long, trailing stems, each normally carrying more than one flower			densely tufted, each stem normally with 1 flower only
Chromosome number	?	2n = *c.* 60	?	2n = 20

soon found to represent two different species (see Table II and Fig. 2). One of these (*A*), which occurs also on Cameroons Mt. and Fernando Po in West Africa, is always provided with a distinct corolla, its seeds are normally smaller than 0.50 mm[1] and pronouncedly papillate, and its main branches are often lax and trailing, usually carrying more than one flower each. The other one (*B*) is normally apetalous, its seeds are longer than 0.48 mm and almost smooth or sometimes with a faintly reticulate surface; it is always densely tufted, and its main branches rarely carry more than one flower each. The somatic chromosome number was found to be *c.* 60 in the former (counted on seedlings from Hedberg 220 from

[1] This refers to seeds in well-filled capsules; in capsules where most seeds are aborted the few remaining ones may occasionally be larger.

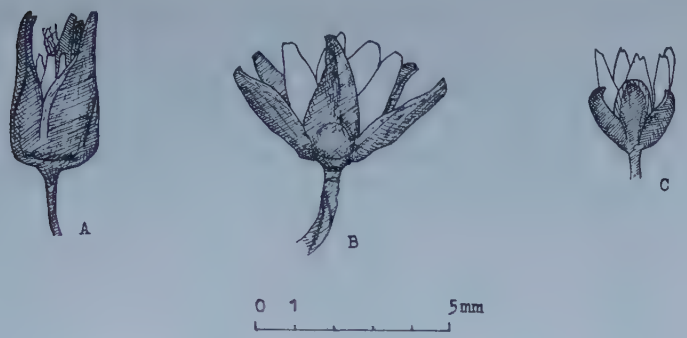

Fig. 3. Opened capsules of: A) *Sagina abyssinica* Hochst. ex A. Rich. (drawn from Schimper II: 1148, the isotype at Kew); B) *Sagina afroalpina* Hedb., n. sp. (drawn from Hedberg 1250, the holotype at Uppsala); *Sagina brachysepala* Chiov. (drawn from Chiovenda 2938, the holotype at Firenze). The sepals are hatched, the capsule valves are left blank.

Elgon, and Hedberg 1412 from Kilimanjaro) and 20 in the latter (counted on Hedberg 1250 from Kilimanjaro). The first of these two agrees in most respects very well with the Ethiopian material of *Sagina abyssinica*, differing mainly in the texture of the seed surface, which in the Ethiopian material is almost smooth or faintly reticulate in the same way as in "species *B*" from equatorial East Africa. The typical *S. abyssinica* also tends to have larger seeds and coarser tufts than "species *A*" in equatorial Africa. The difference in texture of the seed surface between the Ethiopian plant and "species *A*" evidently merits some taxonomic distinction, but since no other constant morphological differences could be found between the two it appears most suitable to treat them as only subspecifically distinct. "Species *A*" is described below as *Sagina abyssinica* ssp. *aequinoctialis* Hedb.

"Species *B*" mentioned above is apparently identical with "*Sagina abyssinica* f. *apetala*" of Hauman (1933 p. 704). Its relations to the Ethiopian *S. brachysepala* are less clear. The latter, which is known from the type specimen only, was stated by Chiovenda (1911 p. 52) to differ from *S. abyssinica* mainly in its shorter sepals and leaf sheaths. A detailed study of the type specimen, which was obtained on loan from the University Herbarium, Firenze, indicates that *S. brachysepala* is distinct both from *S. abyssinica* and from "species *B*". The main differences between them are recorded in Table III. Since "species *B*" is apparently distinct from all previously known African species it is described below, under the name

Sagina afroalpina Hedb. The normal shape of the calyx and opened fruit in the three species concerned is shown in Fig. 3.

Obviously more material of *Sagina brachysepala* is required to settle its taxonomic position and its relations to *S. abyssinica* and *S. afroalpina*. All three species occur in the same area in the province of Simien in N. Ethiopia.

Survey of afro-alpine species.[1]

Silene.

S. burchellii Otth in DC Prodr. I, p. 374 (1824). Type: South Africa, Cape prov., Kloof between Lion's Head and Table Mt., Burchell 271 (K, iso.!).

Synonyms: *S. chirensis* A. Rich. Tent. Fl. Abyss. 1, p. 44 (1847). Type: Ethiopia, Chire prov., July 1840, Quartin Dillon s. num. (P, holo.; K, iso.!). — *S. sericea* A. Rich. op. cit., p. 43; non All. — *S. meruensis* Engl. Bot. Jahrb. 48, p. 382 (1913). Type: Tanganyika, "Kilimanjaro distr." (Mt. Meru?), 3600 m, Nov. 1901, Uhlig 598 (B, syn. †; EA!); and Tanganyika, Mt. Meru, W slope above the forest limit, Oct. 1904, Uhlig 463 (B, syn. †).

Stellaria.

St. brauniana (Engl.) Robyns Fl. Sperm. Parc Nat. Alb. 1, p. 158 (1948). Type: not defined.

Synonyms: (*St. brauniana* Fenzl ex Schweinf. Beitr. Fl. Aeth., p. 60 (1867), nomen nud.) *St. media* var. *brauniana* Engl. Pflanzenw. Ost-Afr. C, p. 176 (1895). Type: not stated.

Sagina.

S. abyssinica Hochst. ex A. Rich. Tent. Fl. Abyss. 1, p. 47 (1847).

[ssp. ***abyssinica***. Type: Ethiopia, Simien, near Demerki, Aug. 1838, Schimper II: 1148 (P, holo.; K, iso.!; FI, iso.!).]

ssp. ***aequinoctialis*** Hedb., n. ssp.

Peraffinis *Saginae abyssinicae* (ssp. *abyssinicae*), a qua differt: Semina saepe minora (0.34–0.49 mm longa), distincte papillosa, moriformia, opaca (in ssp. *abyssinica* 0.43–0.50 mm longa, laevia vel leviter reticulata, ± nitentia). — Type of ssp.: Tanganyika, Kilimanjaro, above Peter's Hut in the lower part of the alpine belt, 4130 m, below a boulder, 27.6. 1948, Hedberg 1412 (UPS, holo.!).

[***S. brachysepala*** Chiov. Ann. di Bot. 9, p. 52 (1911). Type: Ethiopia, Simien, Debarek, 30.11. 1909, Chiovenda 2938 (FI, holo.!).]

[1] The following abbreviations have been used for herbaria: B = Berlin-Dahlem; EA = East African Herbarium, Nairobi; FI = University Herbarium, Firenze; K = Royal Bot. Gardens, Kew; P = Muséum d'Histoire Naturelle, Paris; UPS = Botanical Museum, Uppsala. The sign † means that the specimen is probably destroyed.

S. afroalpina HEDB., n. sp.

Herba perennis, a basi ramosa, ± dense caespitosa. *Cauliculi* primarii steriles, rosuliferi, ex axillis inferioribus ramos floriferos emittentes. Rami secundarii 5–20(–65)[1] mm longi, haud ramosi, uni- (vel bi-)flori. *Folia* glabra, linearia, apice in aristam 0.1–0.2(–0.4) mm longam contracta, basi bina in vaginam c. 2 (1.0–2.8) mm altam connata; rosularia 8–18 mm longa et 0.8–1 (0.5–1) mm supra vaginam lata, caulina 4–7(–10) mm longa et 0.3–0.8 mm lata. *Flores* axillares, pentameri. Pedunculi erecti, glabri, 2–16 (1–16) mm longi, (0.3–)0.4–0.5 mm crassi, cortice contracto apice transverse rugosi et pro maxima parte pseudo-alati. *Calyx* campanulatus, coriaceus. Sepala ovata, viridia, 2.5–3 (1.7–3.3) mm longa, margine anguste membranacea et saepe purpurea, basi pseudo-articulata, apice cucullata. *Corolla* nulla (vel subnulla). *Capsula* ovato-globosa, obtusa, sepala aequans sed haud superans, 5-valvata; valvis ovatis obtusis. *Semina* ovato-reniformia vel irregulariter compressa, 0.50–0.63 (0.45–0.65) mm longa, teretia vel levissime reticulata, ± nitentia. — Type: Tanganyika, Kilimanjaro, W. slope of Mawenzi, 4600 m, by a small brook, 17.6. 1948, Hedberg 1250 (UPS, holo.!).

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[1] Figures in brackets refer to measurements on other specimens than the type.

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CYTOTAXONOMICAL REMARKS ON SOME AMERICAN SPECIES OF CIRCUMPOLAR TAXA.

BY

ÁSKELL LÖVE.

(Department of Botany, University of Manitoba, Winnipeg, Canada.)

When plant taxonomy first became a science, discontinuous morphological characters were regarded as the essential indication of species, and even today taxonomists recognize only taxa that are morphologically distinct. In early times the distinguishing characters used were generally many and conspicuous, but later botanists realized that although some species may differ in gross characters, others may be just as distinct but by differences in minor features. Furthermore, although morphological differences are essential to recognition of the units of evolutionary classification, recent taxonomists are quite aware that these differences are not the primary movers in the evolution of taxa. The determinative factor in the change of the intraspecific race into a distinct species is the development of a barrier of sterility or incompatibility towards its relatives.

Sterility barriers and morphological discontinuity have been known for a long time, but only recently has it been satisfactorily demonstrated that their development can follow two fundamentally different lines. Usually, in populations which are more or less isolated geographically, a sterility barrier is gradually built up by a progressive change in cytological characters accompanied by morphological and physiological alterations. This process of species formation, termed gradual speciation (cf. Valentine 1949; Löve 1951), provides, at least in its early stages, for entities that are transitional between the major geographical race and the true species. Wherever the major races or subspecies meet, they form fertile or

only partially sterile hybrids, totally wiping out the boundaries between them in that area, while good species are able to occupy the same locality without risking their independence, although some introgressive hybridization may occur between them.

Less frequently a sterility barrier is produced suddenly by a change in chromosome number, which automatically isolates the new taxon very effectively without intermediate races between it and its relatives. This process, named abrupt-speciation by experimental taxonomists (cf. VALENTINE 1949; LÖVE 1951), is then followed by a slow diversification of morphological and physiological features.

Experimental studies on race differentiation and the evolution of species are tedious, and so most of the information we have about this process has been collected by taxonomists and geobotanists studying the morphology and geographical distribution of taxa. With such information alone, however, taxonomists have not always agreed on the taxonomic status of gradual species *in statu nascendi*; some are grouped as intraspecific races, others regarded as good species. Experimental taxonomists studying the sterility barriers between such populations have, on occasion, demonstrated the presence of the sexual isolation essential for specific status, while more often they have been able to confirm the views of the taxonomist and geobotanist as to the intraspecific character of even morphologically distinct populations.

Being unaware of the abrupt-speciation process whose species may differ from each other by only minor but discontinuous morphological characters, even the most able taxonomists, so shrewd in distinguishing true intraspecific races from good species of the gradual group, often fail to observe the distinctness of abrupt-species. Probably, this is due not only to the fact that this type of evolution of sterility barriers is considerably rarer than the gradual process, but also that the more conspicuous characters are frequently common to both taxa even millions of years after their original isolation.

In any case, it must be realized that morphological and geographical studies must be correlated with cytogenetical data when available to elucidate the evolution of species. An excellent illustration of this point lies in the consideration of the circumpolar boreal species of higher plants.

Several taxonomists and geobotanists have made valuable contributions to the study of the variation and distribution of plants in the

circumpolar boreal region. Of these the most extensive investigations were made by two of the outstanding geobotanists of our century, FERNALD (1950 and earlier) and HULTÉN (1937 a, b, 1941–1950 a, b, and earlier). FERNALD concentrated on the plants of eastern North America with emphasis on their relations to populations in other parts of the world; HULTÉN has studied the flora of the northern Pacific region as well as that of Fennoscandia, mainly from the point of view of their dispersal and chorological history. In most cases these prominent scientists have reached the same conclusions as to the classification of a particular taxon as a race or a species, but in some cases they have disagreed. As far as can be seen from the material hitherto studied cytotaxonomically by the present writer, HULTÉN has been keener than FERNALD in discovering intraspecific races of species in a state of gradual-differentiation, while FERNALD had a more discriminating eye for the discontinuity of the abrupt-species. This could be demonstrated by many examples from the present writer's studies of hundreds of populations of gradual-species and their races from western Europe and North America.

A number of abrupt-species, wrongly classified by most contemporary taxonomists as races of the same species, have been discovered by the writer in his cytotaxonomical comparisons of Eurasiatic and American populations (LÖVE 1954). A few of these abrupt-complexes are discussed herewith in more detailed fashion than has been possible to this time.

Phyllitis Scolopendrium (L.) NEWM.

The Hart's-tongue fern is usually regarded as one collective species with a very disrupted range. Originally described from Sweden by LINNÆUS (1753), it is rare in southern Scandinavia (HULTÉN 1950 b; HYLANDER 1953), common in the British Isles, especially in their wetter parts (CLAPHAM, TUTIN, & WARBURG 1952), and fairly frequent in central and southern Europe and North Africa south to the Macaronesian Islands, the mountains of Morocco and Asia Minor to the Caucasus and Persia. This collective species also grows around the Black Sea and the Caspian Sea and in the middle Dnepr region in southern Russia. It is reported to occur also in Japan and southwestern Asia; and in North America it is known from a few localities in southern Ontario and eastern United States, as well as from one place in Mexico.

Until FERNALD (1935) pointed out that the American populations differ from their European relatives not only in their ecological requirements but also in some good taxonomical characteristics, it was generally assumed that these taxa were identical. It has been shown, however, that the American plant is, on the average, much smaller than the European, the indusia are shorter and less numerous, and the scales are delicate and curling, long-caudate and linear-filiform; the midrib is more pronouncedly glabrate, the fronds usually fruit only in the upper half, and the enlarged tips of the veinlets are more elongate and farther from the margin than in the European plant. FERNALD (1935) described the plant as a variety *americana* FERN., although he realized that it differed so essentially from the European taxon that on the basis of morphology alone it might better be considered a distinct species.

At the time when FERNALD (l.c.) made his observations, no cytological information on *Phyllitis* was available, and even today experiments on hybridizing the two taxa have not been performed. Now, however, it is known that the European *Ph. Scolopendrium* in its strict sense is an octoploid plant with $2n = 72$ chromosomes, as reported by MANTON (1950) on British material, while the American taxon has the sexdecimploid number $2n = 144$ as determined by BRITTON (1953) on plants from near Durham in Ontario. Therefore, the two taxa are not only morphologically distinct and geographically isolated but also biologically separated by a strong barrier of sterility, which must have been produced prior to their geographical isolation. The suggestion by FERNALD (1935) that the American plant might perhaps be considered a distinct species is thus supported by experimental taxonomy, and the present writer proposes for it the name ***Phyllitis Fernaldiana*** LÖVE, nov. spec. (based on *Phyllitis Scolopendrium* (L.) NEWM. var. *americana* FERNALD, 1935). The known distribution of the new species as well as of the European taxon is shown in Fig. 1.

The plant from Chiapas in southern Mexico was regarded by FERNALD (1935) as another race of the collective species, or var. *Lindeni* (HOOK.) FERN. It has a very slender and sublanate chaff extending nearly the length of the dorsal midrib; the enlarged tips of the veinlets are marginal and elliptic. Although no cytological study has as yet been made on this plant, its morphological distinctness would suggest at least a provisional status as a separate species, *Ph. Lindeni* (HOOK.) MAXON. The eastern Asiatic material is also in need

Fig. 1. Distribution areas of *Phyllitis*. — Solid line: *Ph. Scolopendrium* s. str. Dots: *Ph. Fernaldiana*.

of a cytotaxonomical investigation and a critical comparison with other taxa of the genus in its strict sense.

Potamogeton perfoliatus L.

Taken in its wide sense, this is a circumpolar taxon with a gap in its area only in Greenland, and composed of three subspecies, two of which occur in North America (Hultén 1941; Clausen 1949). All the Eurasiatic populations seem to be referable to the typical race, while American specimens belong to the ssp. *Richardsonii* (Benn.) Hultén, with the exception of most of the Atlantic material, named as the ssp. *bupleuroides* (Fern.) R. Clausen. However, some American taxonomists are of the opinion that the latter two taxa deserve to be treated as two separate species (Fernald 1908; Rydberg 1905), or that at least *Richardsonii* be named a species, with *bupleuroides* remaining a race of the collective taxon (Ogden 1943; Fernald 1950).

Cytological investigations on the main race of Eurasiatic *P. perfoliatus* have revealed that it is a tetraploid species with $2n = 52$ chromosomes (Palmgren 1939; Felföldy 1947; Löve, unpubl.). Both the North American taxa were found to be diploid with $2n = 26$ chromosomes. Therefore, these are without doubt isolated from the Eurasiatic taxon not only by geographical conditions but also by a strong barrier of hybrid sterility so that they are certainly more correctly treated as specifically different from it.

As hybridizing experiments have not yet been performed between the American diploids, it is not possible to decide if they are to be regarded as two separate species or as only races of one species. If CLAUSEN (1949) is right in the impression that the intermediates in the State of New York appear as fertile as the extremes, the taxon *bupleuroides* should be treated as a race of *P. Richardsonii* (BENN.) RYDB. The observations by OGDEN (1943) indicate, however, that the hybrids are always sterile, and if this is confirmed in experimentally produced hybrids, there will be no doubt that the two taxa are good species. Until this question is definitely settled, it is certainly more appropriate to accept the original view of FERNALD (1908) regarding both the American diploids as specifically distinct.

It is worth while here to mention that *P. Richardsonii* is in some morphological respects intermediate between *P. praelongus* and *P. perfoliatus*, so that HAGSTRÖM (1916) suggested that it might have arisen as a hybrid between these species. Since both these supposed parental species are known to be tetraploid and the American species is diploid, this possibility is excluded, but it is not unlikely that they have both arisen by alloploidy from hybrids between the diploid *P. Richardsonii* and two other different diploid species.

The approximate distribution area of the three taxa mentioned is shown in Fig. 2.

Glyceria maxima (HARTM.) HOLMB.

As HULTÉN (1942) failed to find major differences between Eurasiatic and American plants of the *Glyceria maxima* complex, he decided to regard it as a collective species composed of several races named as subspecies. However, this was not done without some hesitation, since he found the differences in size of the flower parts and especially the anthers of the eastern American and European types to be rather significant. Still, since the Alaskan variety *Komarovii* was found to be intermediate in these characters, he felt that these taxa could not be maintained as separate species. Most American authors, however, regard the taxon of the New World as a separate species, and Russian botanists also divide the collective taxon into more restricted species.

Although cytotaxonomical investigations have not yet been performed on all taxa referable to *G. maxima* in its wide sense, our present knowledge of the chromosome numbers of some of the types makes it clear that more than one biological species are involved.

Fig. 2. Distribution areas of *Potamogeton*. - Solid line: *P. Richardsonii*. Broken line: *P. perfoliatus* s. str. Dot-dash line: *P. bupleuroides*.

The European *G. maxima* in its strict sense, or ssp. *maxima*, is a hexaploid species with 2n = 60 chromosomes, as determined by Fitzpatrick (1946) on British material, Church (1949) on British as well as recently introduced Canadian populations, and by Löve & Löve (unpubl.) on Scandinavian specimens. The same number seems to be typical also for the ssp. *arundinacea* (M. B.) Hultén, since Pólya (1949) reported the inexact number 2n = 56 from Hungary.

The American species *G. grandis* S. Wats. is a diploid with 2n = 20 chromosomes, as counted by the present writer on Manitoba material and by Church (1949) on plants from Massachusetts, New York, and Utah.

As pointed out by HULTÉN (1942), the Alaska-Yukon representatives of this group described as the variety *Komarovii* by KELSO (1934) have anthers and spikelets intermediate in size between the typical European and the eastern American plant. It has purple-tinged sheaths, and in other characters it is more suggestive of the European than the American species. The chromosome number of individuals of this race from seeds was found to be 2n = 40.

From the point of view of cytotaxonomy there is no doubt that the European species *G. maxima* with its ssp. *arundinacea* is specifically different from the American *G. grandis*. Moreover, it is evident that the Alaska-Yukon plant referred to as the variety *Komarovii* of the American species is also worthy of specific status. Since eastern Asiatic material of taxa described in the Flora SSSR as different species still remains cytologically unknown, it may be appropriate at present to segregate the Alaska-Yukon tetraploid as a separate species; and it is proposed that it be named the species ***Glyceria Hulteniana*** LÖVE, spec. nov. (based on *Glyceria grandis* S. WATS. var. *Komarovii* KELSO, 1934). If the eastern Asiatic species will be found to be tetraploid as well, experiments may decide their relation to the new species and to each other.

Heleocharis quinqueflora (HARTM.) SCHWARZ.

This species, which is identical with *H. pauciflora* (LIGHTF.) LINK (cf. SCHWARZ 1949), belongs, according to HULTÉN (1950 b), to the group of incompletely boreal-circumpolar plants with gaps in Asia and in the Pacific. The eastern American populations have been referred to a variety *Fernaldii* by SVENSON (1934), while the western plants have been named the var. *Suksdorfiana* (BEAUVERD) SVENSON (SVENSON 1929).

The chromosome number of the European taxon has been determined by KNABEN (1950) and the present writer on Norwegian and Icelandic material respectively. Exact counts could not be made but the diploid number was found to be in the vicinity of 2n = 100 chromosomes. Eastern American material of the var. *Fernaldii* was, however, found to have 2n = 80 chromosomes, or certainly a lower number than the European species. It is, therefore, justifiable to exclude the eastern American taxon from the collective species, raising its status to that of a separate species, namely: ***Heleocharis Fernaldii*** (SVENSON) LÖVE, spec. nov. (based on *Eleocharis pauciflora* (LIGHTF.)

LINK var. *Fernaldii* SVENSON, 1934). When the western plant, var. *Suksdorfiana*, is further investigated it will probably also be more accurately classifiable as a distinct species.

Carex echinata MURR.

Taken in its collective sense, this species is not only circumpolar in the north but also occurs in Santo Domingo, the Azores, Australia, and New Zealand (cf. HULTÉN 1942). European and Japanese material has been found to have $2n = 58$ chromosomes (WULFF 1939; TANAKA 1948; LÖVE, unpubl.). American plants referable to the species *C. angustior* MACK. and *C. cephalantha* (BAILEY) BICKN. are found to have $2n = 52$ and $2n = 50$ chromosomes, respectively (LÖVE 1954). Although FERNALD (1950) regards them as only varieties, and CLAUSEN (1949) lists the former as a species, the latter a subspecies, they are certainly both better classified as good species of the same complex which includes the still collective species *C. echinata*.

Chenopodium hybridum L.

Although this collective species is taken in its wide sense by many American authors (CLAUSEN 1949; JONES 1950), its New World populations differ so markedly in their seed characters from the European plant that AELLEN (1929) did not hesitate to regard the former as a separate species, *Ch. gigantospermum* AELLEN. According to ROULEAU (1944), however, the American plant is more correctly treated as a race or variety of the European species, a suggestion accepted by FERNALD (1950), while HULTÉN (1944) accepts AELLEN's treatment. Cytotaxonomically the two taxa are evidently good species, since the Eurasiatic plant is a diploid with $2n = 18$ chromosomes (WINGE 1917; PÓLYA 1949; LÖVE, unpubl.), while the present writer was able to confirm the finding by COOPER (1935) that the American taxon is a tetraploid with $2n = 36$ chromosomes. The American material studied so far suggests that the plant is probably an alloploid, presumably between *Ch. hybridum* L. s. str. and some other closely related diploid.

Pulsatilla patens (L.) MILL.

This species in its widest sense does not have a circumpolar coverage, since it does not occur in eastern North America. According to ZĀMELS (1926), it may be divided into at least five morphologically

distinct races, named by him as subspecies. The violet-flowered main type, ssp. *patens* or ssp. *latifolia* (RUPR.) ZÄMELS, grows in Siberia and most parts of European Russia, and also occurs in Scandinavia (HULTÉN 1950 b) as well as in central Europe westwards to central and eastern Germany. The yellow-flowered ssp. *uralensis* ZÄMELS is described from eastern Russia and western Siberia, while the likewise yellow-flowered ssp. *flavescens* (ZUCC.) ZÄMELS is found from eastern Russia over the southern parts of Obi, Yenisei, and Lena river basins to Olenek River and the mouth of the Kolyma River. The violet-flowered ssp. *multifida* (PRITZEL) ZÄMELS is also Siberian and grows from eastern Russia through the southern parts of Obi and Yenisei river basins, in Dahuria, Zeja-Bureja and Ochotsk to Anadyr and Kamtchatka. The fifth subspecies studied by ZÄMELS (l.c.) is the American violet-flowered ssp. *hirsutissima* ZÄMELS, differing from the Siberian plant in somewhat deviating leaf-form and confined to western and central North America. Its name as subspecies is based on the species *Clematis hirsutissima* PURSH, which certainly has nothing to do with this species.

According to JUZEPCZUC (1937), each of ZÄMELS's subspecies deserves specific rank, with the exception of ssp. *uralensis*. On the other hand, HULTÉN (1944) substantially accepts ZÄMELS's treatment, except for two points. First, he refers the species itself to the genus *Anemone* in its widest sense. Secondly, as he can "see no essential differences between the Siberian plant (ssp. *multifida*) and the American (ssp. *hirsutissima*)", he includes both in the ssp. *multifida*. Otherwise, he supports ZÄMELS's classification and discredits JUZEPCZUC's with the statement that, since the different races of the collective species form intermediates where they meet, they cannot be considered separate species.

It is worth while, here, to emphasize that hybrids between these taxa are as rare as hybrids between other species of *Pulsatilla* accepted by HULTÉN (l.c.) as good species, and that they are considerably less frequent in herbaria than might be expected from his statement. The fact that the taxa are clearly distinguishable throughout their common range in Siberia also contradicts his claim. Furthermore, cytotaxonomical evidence provides partial corroboration of JUZEPCZUC's viewpoint. The main type from Eurasia, *P. patens* s. str., is a diploid plant with $2n = 16$ chromosomes (BÖCHER 1932; ROSENTHAL 1936; TARNAVSCHI 1948; LÖVE, unpubl.), while the American plant studied by the present writer on material from

Fig. 3. Distribution areas of *Pulsatilla*. — Solid line: *P. ludoviciana*. Broken line: *P. patens* s. str.

Manitoba is a tetraploid with 2n = 32 chromosomes. At least these two are definitely distinct.

Although the yellow-flowered taxa remain cytologically unknown, there is doubt as to the occurrence of really intermediate forms or fertile hybrids between them and any of the violet-flowered taxa; therefore, they are probably races of a separate species, *P. flavescens* (Zucc.) Juz.

However, as to the conspecificity of the American taxon and the Siberian *P. multifida*, Hultén (l.c.) appears to be right. They are also so close morphologically, that they cannot be considered even different races. This fact makes it unavoidable to discard the name *P. multifida* for this taxon, since the American plant had already

been given a validly published name at least twice in the same year in the first part of the last century, namely: *Anemone ludoviciana* by NUTTALL (1818), and *A. Nuttalliana* by DE CANDOLLE (1818), both descriptions based on the same collection. Transferred to the genus *Pulsatilla*, the American-Siberian species seems to be *P. ludoviciana* (NUTT.) HELLER, as published by HELLER (1900). The approximate distribution areas of both the violet-flowered species are shown in Fig. 3.

Pentaphylloides fruticosa (L.) SCHWARZ.

The conventional treatment of the genus *Potentilla* as a group including a large number of remotely related sections is very unsatisfactory from the evolutionary point of view. It is likely that most of these sections have evolved from a common ancestor, but others seem to be no more closely related to this group of *Potentilla* species than to other genera of Rosaceae. For example, the group *Comarum* shows as little morphological similarity to *Potentilla* in its strict sense as even *Anserina*, and the group *Sibbaldiopsis* is probably closer to *Sibbaldia* and *Fragaria* than to the main bulk of *Potentilla* proper. Of all sections of the genus in its wide sense the most distinct, both morphologically and anatomically, is the group *Fruticosae* which includes perennial shrubs, pinnately leaved with entire leaflets and hairy fruits.

There is little doubt that the shrubby plants of the *Fruticosae* group have been isolated from other taxa of *Potentilla* for a long time, and the present distribution of the taxa indicates that they are old and well established types. The group is represented in eastern Asia by several taxa, and it is also known from several fairly well isolated localities in western and southern Europe as well as on the North American continent.

Taxonomically the *Fruticosae* group doubtlessly deserves the rank of a separate genus, distinct from *Potentilla* even in its wider sense. This is evident from the morphology and anatomy of the plant, and further strengthened by the fact that these shrubs are completely unable to cross with any other section even under favourable experimental conditions.

As a genus, the fruticose *Potentillae* have been named *Dasiphora* by RYDBERG (1898, 1908) and JUZEPCZUC (1941), thus accepting a generic name given to the American plant by RAFINESQUE (1838). However, as pointed out by SCHWARZ (1949), this is not the first

name validly published for this group as a genus, since DUHAMEL (1755) used *Pentaphylloides*, thus accepting and validating a pre-Linnæan name. Although the former name has been used somewhat more frequently than the older, there is no adequate reason for conservation, and the present writer fully agrees with SCHWARZ (l.c.) that the name *Pentaphylloides* DUH. should be accepted as the correct name of the genus.

Although several species of this group have been described by various authors, mainly from eastern Asia, their real taxonomical status still remains somewhat obscure. JUZEPCZUC (1941) recognized three sections and six species within the boundaries of the Soviet Union, and HANDEL-MAZZETTI (1939) regarded several other Asiatic units as good species; but HARA (1952) finds the differences between species from different sections so unclear that he considers them only geographical races of one collective species.

The species *Pentaphylloides fruticosa* (L.) SCHWARZ was originally described by LINNÆUS (1753) as a species of *Potentilla*. Although it is stated that the species "habitat in Eboraco Angliae, Oelandia australi, Siberia", there is no question that LINNÆUS knew the European plant best; therefore, since British and Swedish specimens seem to be identical, it is logical that they be regarded as typical for the Linnæan species. Cytologically, this species is characterized by the tetraploid chromosome number $2n = 28$, as determined by TURESSON (1938) on material from Öland in Sweden.

As pointed out by SAX (1931) and TURESSON (1938), plants of this group from North America differ from the European plants not only morphologically but also in their chromosome numbers, being diploids with $2n = 14$ chromosomes. The present writer has been able to confirm this number for several populations from Manitoba, and studies on herbarium material reveal that all American plants of the group are certainly conspecific though ecologically variable. The same chromosome number has also been reported by SHIMOTOMAI (1930) for Japanese material of the related species *Pentaphylloides arbuscula* (D. DON) LÖVE, comb. nov. (based on *Potentilla arbuscula* D. DON, 1825).

From the point of view of experimental taxonomy, the diploid American plant is a good species distinct from the Linnæan taxon. Morphologically as well, differing in form, hairiness and venation of the leaves, American specimens are clearly distinguishable from the European material studied. While the leaves of the European species

are soft-hairy, those of the American plants are subglabrous to silky; where the veins of the leaves of *P. fruticosa* are thin and colourless in a wide-mesh network, and the leaf-margins remain flat, the American plant has leaves with thick, closely meshed veins, and margins usually more or less revolute; the usually five leaflets are short, oblong-lanceolate in the European plant, narrower and longer in the American populations; and other differences also exist.

Although most authors have regarded the American plant as identical with the Linnæan taxon, it has been given separate names by some orthodox taxonomists. RAFINESQUE (1838) named the American species of his new genus *Dasiphora riparia*, and TRATTINICK (1824) gave it the name *Potentilla Loureironis* TRATT. The oldest validly published name of the American species seems, however, to be *Potentilla floribunda*, published by PURSH (1814).

It is evident from the flora by PURSH (l.c.) that he was of the opinion that only a part of the American populations of this plant belonged to his new species, since he also lists the Linnæan species from this continent. As this was clearly a mistake and the description given fits our plant well in all its phases, the name *P. floribunda* is to be regarded as the oldest valid binomial for the American species in its wide sense. Transferred to a separate genus, the name of the American representative of this group should be named *Pentaphylloides floribunda* (PURSH) LÖVE, comb. nov. (based on *Potentilla floribunda* PURSH, 1814, and including also *P. fruticosa* PURSH and American authors, not LINNÆUS 1753).

The general distribution of *P. fruticosa* in its strict sense is not known with certainty, nor is the Asiatic distribution of *P. floribunda*. The entire genus, and especially its eastern Asiatic taxa need to be monographically studied, and since morphology and chorology alone have failed to clarify the status of its various entities, such monographical investigation should be based on the methods of modern cytotaxonomy and genecology.

Potentilla norvegica L.

LINNÆUS (1753) recognized a Eurasiatic species which he named *Potentilla norvegica*, and a second species, *P. monspeliensis*, which he knew only from cultivated specimens from Montpellier. This was the American plant. It differed from the species *P. norvegica* L. in that it had "caule ramoso erecto, pedunculis supra genicula enatis", while the European taxon was characterized by "caule dichotomo,

pedunculis axillaribus". Later (Linnæus 1762) it was also pointed out that the American plant has broader leaves, blunt, with obtuse teeth. The taxon was given the name *P. hirsuta* by Michaux (1803), who pointed out that these American populations are more pronouncedly hirsute than the European specimens, and De Candolle (1813) renamed it *P. Morisoni*, a name accepted by Seringe (in De Candolle 1825), though with some doubt as to the species value of the plant.

Torrey & Gray (1839) seem to have been the first to unite the two Linnæan species in one taxon, selecting the name *P. norvegica* L. for the collective species. Rydberg (1898), agreeing that both taxa were only races of one species, chose the name *P. monspeliensis* for the collective taxon, an unnecessary synonym. Torrey & Gray (l.c.) regarded the European plant as the type form of the collective species, while the American race was named as the form β *hirsuta* (Michx.) T. & G. In present American manuals it is usually named the variety *hirsuta* (Michx.) Lehm. (cf. Lehmann 1856), while the European variety is called var. *genuina* Wolf.

Ascherson & Graebner (1904) regarded the hairy American plant as a major race and named it II. *Monspeliensis*. Since they usually indicated subspecies in this way, Hultén (1946) accepted this as a subspecies combination for the American plant, but Hylander (1945) regarded it an illegitimate combination since the taxonomical level of the name was not clearly indicated, and renamed the plant ssp. *hirsuta* (Michx.) Hyl.

Further discussion of the valid subspecific name of the American taxon is unnecessary, since it has been shown that, while the European plant is a decaploid with $2n = 70$ chromosomes (Gentcheff 1938; Löve, unpubl.), the American taxon is an octoploid with $2n = 56$ chromosomes, as counted on Manitoba material by the present writer. This confirms the original treatment by Linnæus (1753) regarding the species value of the American populations, and although Hultén (1946) declares that "the variations of the main type and subsp. *monspeliensis* overlap", this is a somewhat doubtful statement in the light of the fact that both species seem to be obligate agamosperms.

Small individuals of the collective taxon from northeastern North America have been regarded as a variety *labradorica* (Lehm.) Fern. of *P. monspeliensis* (Fernald 1908) or of *P. norvegica* (Fernald 1926, 1950). Although this may well be a major geographical race

of the American species, there is also the possibility that these populations may differ in chromosome number from the other plants of this continent. Therefore, until they have been cytologically investigated, it is perhaps advisable to regard them as separate species, *P. labradorica* LEHM., as originally proposed by LEHMANN (1856). A species should not be reduced to a variety except after thorough investigation, since it is without doubt always "a lesser evil to keep forms separated that are identical than to identify such as are distinct" (HALLE 1913).

Lathyrus palustris L.

The Vetchling is usually taken in its wide sense by contemporary authors of manuals so that it is said to be circumpolar in distribution. However, this does not mean that distinct morphological variations are absent, and FERNALD (1911, 1950) divides the American populations into the main type and five varieties, at least three of which have been considered separate species by earlier taxonomists. HULTÉN (1937 b, 1947) regards two of these taxa as forms of the ssp. *pilosus* (CHAM.) HULTÉN, while the remaining types are included in the main type of the species.

Cytotaxonomically some objections can be made against the treatment just mentioned. The European populations of true *L. palustris* have been found to be hexaploid with $2n = 42$ chromosomes, as shown by SCHEERER (1940) on German plants, LÖVE & LÖVE (1944) on Swedish material, and the present writer (LÖVE, unpubl.) on Icelandic specimens. Individuals from Manitoba, belonging to the ssp. *pilosus*, however, are diploid with $2n = 14$ chromosomes, and that number was also determined by SENN (1938 a, b) on other Canadian material.

Although detailed cytotaxonomical studies are needed on other races of the collective species, it is evident that the European and American taxa with $2n = 42$ and 14 chromosomes, respectively, cannot be conspecific. Until such investigations have been performed, it is certainly justifiable to regard the more northern type in North America and Asia as a diploid species *L. pilosus* CHAM., while the southern glabrous type on this continent is perhaps conspecific with the European hexaploid *L. palustris* L. With regard to the other varieties found in America, var. *macranthus* (T. G. WHITE) FERN. and var. *myrtifolius* (MÜHL.) GRAY, since it must be demonstrated

Fig. 4. Distribution areas of *Myriophyllum*. — Solid line: *M. exalbescens*. Broken line: *M. spicatum*.

to which species they may belong, it is also wiser to take them provisionally as separate species, *L. macranthus* (T. G. White) Rydb. and *L. myrtifolius* Mühl.

***Myriophyllum spicatum* L.**

A circumpolar taxon if taken in its wide sense, this collective species was divided by Fernald (1919) into the Eurasiatic *M. spicatum* s. str. and the American species *M. exalbescens* Fern. The latter differs from the Linnæan species in having fewer pairs of leaf segments on the primary stems, bracts which are spatulate-ovate or oblong-cochleiform instead of rhombic-obovate as in *M. spicatum*, and bracteoles which are ovate and entire. The anthers of American

plants are distinctly shorter than in European specimens, and while winter buds are unknown from the European plant, they are the rule in all American material seen by the writer (cf. also PORSILD 1939).

Despite the differences in morphology between the two taxa, HULTÉN (1947) judged that they should more correctly be treated only as different races of the Linnæan species. Therefore, he regarded the American plant as ssp. *exalbescens* (FERN.) HULTÉN, a treatment accepted by CLAUSEN (1949) and HARA (1952), but rejected by FERNALD (1950). The geographical distribution of both types is shown in Fig. 4.

The Eurasiatic taxon has been studied cytologically by the present writer on material from Lake Mývatn in northern Iceland, and was found to be tetraploid with $2n = 28$ chromosomes (reported in error as $2n = 36$ by LÖVE & LÖVE 1948). On the other hand, species from Lake Manitoba have shown a diploid count, with $2n = 14$ chromosomes. Hence, the original view by FERNALD (1919) that these two taxa are distinct species, is confirmed by the cytotaxonomical observations.

Galium boreale L.

The Northern Bedstraw has been found to include a tetraploid and a hexaploid taxon with $2n = 44$ and 66 chromosomes respectively. The tetraploid is the Linnæan species of Europe and western Asia, while the hexaploid is an Asiatic-American taxon more correctly named the species *G. septentrionale* R. & S. A detailed study on these species and their morphology and distribution is published elsewhere (LÖVE & LÖVE 1954).

Summary.

(1) Sterility barriers in higher plants are evolved in two main ways. The more common one is gradual-speciation, whereby transitional forms are produced in the early stages; but more rarely the species is formed abruptly, without leaving transitional intermediates.

(2) Cytological evidence has confirmed the racial status of most American taxa of circumpolar species, as classified by contemporary taxonomists. However, in a number of circumpolar taxa, it has been shown that their evolution has been based on abrupt-speciation so that the types regarded as only races by some taxonomists differ in

their chromosome number and are better treated as different species. Twelve examples of such taxa are discussed.

(3) The following chromosome numbers are reported for these entities from material studied by the writer: *Potamogeton perfoliatus* L., 2n = 52; *P. Richardsonii* (Benn.) Rydb., 2n = 26; *P. bupleuroides* Fern., 2n = 26; *Glyceria maxima* (Hartm.) Holmb., 2n = 60; *G. grandis* S. Wats., 2n = 20; *G. Hulteniana* Löve, 2n = 40; *Heleocharis quinqueflora* (Hartm.) Schwarz, 2n = c. 100; *H. Fernaldii* (Svenson) Löve, 2n = 80; *Carex echinata* Murr., 2n = 58; *C. angustior* Mack., 2n = 52; *C. cephalantha* (Bailey) Bickn., 2n = 50; *Chenopodium hybridum* L., 2n = 18; *Ch. gigantospermum* Aellen, 2n = 36; *Pulsatilla patens* (L.) Mill., 2n = 16; *P. ludoviciana* (Nutt.) Heller, 2n = 32; *Pentaphylloides floribunda* (Pursh) Löve, 2n = 14; *Potentilla norvegica* L., 2n = 70; *P. monspeliensis* L., 2n = 56; *Lathyrus palustris* L., 2n = 42; *L. pilosus* Cham., 2n = 14; *Myriophyllum spicatum* L., 2n = 28; *M. exalbescens* Fern., 2n = 14; *Galium boreale* L., 2n = 44; *G. septentrionale* R. & S., 2n = 66.

(4) The following new combinations and names are proposed: *Phyllitis Fernaldiana* Löve, *Glyceria Hulteniana* Löve, *Heleocharis Fernaldii* (Svenson) Löve, *Pentaphylloides floribunda* (Pursh) Löve, and *Pentaphylloides arbuscula* (D. Don) Löve.

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SMÄRRE UPPSATSER OCH MEDDELANDEN.

Föreningens medlemmar uppmanas att till denna avdelning insända meddelanden om märkliga växtfynd o. d.

Klockljung (Erica Tetralix) funnen vid Skinnskatteberg i Västmanland.

Under exkursioner på Skinnskattebergs kronopark ha vi under de senaste åren träffat på klockljung på tre olika ställen. Som klockljung — så vitt vi veta — förut icke observerats i Västmanland, torde ett närmare omnämnande av dessa fynd kunna vara av ett visst intresse.

Fynden ha gjorts på följande platser:

1. torvmark strax N om sjön Dramboln, ungefär $^1/_2$ mil Ö om Skinnskattebergs samhälle,
2. torvmark, 300 m NNW om föregående, och
3. myren Slåttermossen, ca 3 km N om föregående torvmarker.

Fyndplats 1. Dramboln-torvmarken är en helt liten torvmark, 200 m lång och 120–140 m bred, som i sin norra del mottager talrika tillrinningar och avbördas söderut mot sjön Dramboln. *Erica* uppträder på Drambolntorvmarken i dess norra del och i ett individantal av minst ett hundratal exemplar. Den ingår där i ett *Myrica-Molinia - Sphagnum papillosum*-samhälle, som h.o.v. genomsättes av *Sphagnum fuscum*-tuvor, bevuxna med olika träd och ris.

Då vi den 2 juli 1953 besökte torvmarken, antecknades inom det område, där *Erica Tetralix* uppträder, följande växter. De med * angivna växterna äro företrädesvis bundna till *fuscum*-tuvorna.

Träd, s+, flvs r: *Alnus glutinosa* t, *Betula pubescens* e+, **Picea Abies* e+, **Pinus silvestris* s (oftast 0,5–6 m hög), *Rhamnus Frangula* e, **Sorbus aucuparia* e.

Buskar, r: *Juniperus communis* e, *Myrica Gale* r (0,8–1 m hög), *Salix aurita* e.

Ris, s: *Andromeda Polifolia* e, **Calluna vulgaris* t (på tuvor y), *Erica Tetralix* e, **Ledum palustre* e, **Lycopodium annotinum* e, **Vaccinium Myrtillus* e, **V. Oxycoccos* e+ (på tuvor y), **V. uliginosum* e, **V. Vitis-idaea* e.

Gräs och örter, y: *Agrostis canina* e, **Anemone nemorosa* e, *Carex dioeca* e, *C. echinata* e, *C. panicea* e, *C. pauciflora* e, *Cirsium palustre* e, *Drosera anglica* e, **D. rotundifolia* e, *Eriophorum vaginatum* e, *Galium boreale* e, *G. uliginosum* e, *Juncus alpinus* e, *Melampyrum pratense* e, *Molinia coerulea* y (1 m hög och frodvuxen), *Orchis maculata* e, *Polygala vulgaris*

e, *Potentilla erecta* e, *Succisa pratensis* e, *Trientalis europaea* e, *Viola palustris* e.

Mossor, y: **Aulacomnium palustre* e, *Calliergon stramineum* e, **Dicranum undulatum* e, **Pleurozium Schreberi* e, **Polytrichum commune* e, **P. strictum* e, *Sphagna* tillsammans y (*Sphagnum apiculatum*, **S. fuscum* på ristuvor y, **S. Girgensohnii*, *S. imbricatum*, *S. magellanicum*, **S. nemoreum*, *S. papillosum* inom öppnare partier r, **S. parvifolium*, *S. pulchrum*, *S. Warnstorfianum*), *Webera sphagnicola* e (bestämningen utförd av fil. dr Herman Persson).

Lavar, e på ristuvor: bl.a. **Cladonia rangiferina* och **C. sylvatica*.

Fyndplats 2 är en torvmark av ungefär samma slag som föregående. *Erica* träffas härävenledes i ett *Myrica-Molinia-Sphagnum papillosum*-samhälle, dock med mera sparsamt förekommande tuvor. Klockljungen har på denna plats en något större frekvens än på Dramboln-torvmarken.

Fyndplats 3. Slåttermossen är en vidsträckt, delvis mycket blöt myr. Den intas mestadels av *Carex lasiocarpa-Sphagnum papillosum*-samhällen, men på vissa ställen förekomma också *Myrica-Molinia-Sphagnum papillosum*-samhällen och *Sphagnum fuscum*-samhällen med *Calluna* eller *Ledum* som viktigaste fältskiktsväxter. H.o.v. förekomma även flarkar, i vilka uppträda *Rhynchospora alba*, *Carex limosa* eller *Menyanthes trifoliata* som karaktärsväxter.

Erica Tetralix är inom Slåttermossen bunden till ett *Myrica-Molinia-Sphagnum papillosum*-samhälle, beläget nära myrens västra strand och ungefär halvvägs mellan myrens norra och södra ände. Den växer där i tusentals exemplar.

Nedanstående vegetationsanalys, utförd den 16 oktober 1953, ger en föreställning om samhällets floristiska sammansättning. (Analysen kan emellertid icke göra anspråk på fullständighet, då den utfördes så sent på året.)

Träd, e: *Picea Abies* e (3 dm höga plantor), *Pinus silvestris* e (3–5 dm höga plantor och småträd).

Buskar, t: *Juniperis communis* e, *Myrica Gale* t (3 dm hög), *Salix aurita* e.

Ris, r, flvs y: *Andromeda Polifolia* e, *Betula nana* e, *Calluna vulgaris* t, *Erica Tetralix* s+ (flvs y), *Vaccinium Oxycoccos* e.

Gräs och örter, y: *Carex echinata* e, *C. lasiocarpa* e (i flarkar s), *C. limosa* (i flarkar y), *Drosera rotundifolia* e, *Eriophorum angustifolium* e, *E. vaginatum* e, *Menyanthes trifoliata* e, *Molinia coerulea* y (ganska låg och mager), *Phragmites communis* e (i flarkar t), *Polygala vulgaris* e, *Potentilla erecta* e, *Rhynchospora alba* t–s (i flarkar y), *Scheuchzeria palustris* e (i flarkar r), *Scirpus caespitosus* e, *Succisa pratensis* e.

Mossor, y: *Aulacomnium palustre* e, *Calliergon stramineum* e, *Gymnocolea inflata* e, *Polytrichum strictum* e, *Sphagna* tillsammans y (*Sphagnum apiculatum*, *S. fuscum*, *S. Girgensohnii*, *S. imbricatum*, *S. magellanicum*, *S. papillosum* (y), *S. parvifolium*, *S. plumulosum*, *S. pulchrum*, *S. subsecundum*, *S. tenellum*, *S. Warnstorfianum*).

Lavar, e: bl.a. *Cladonia rangiferina* och *C. sylvatica*.

De nu beskrivna förekomsterna på Skinnskatteberg höra till vårt lands såväl östligaste som nordligaste *Erica*-lokaler. De bilda viktiga förbindelselänkar mellan området för *Erica*'s allmänna förekomst i vårt land (se E. Hultén, Atlas över växternas utbredning i Norden) och den isolerade, ytterst märkliga växtplatsen för klockljung i östra Dalarna — Eliasmyren i Envikens sn — vilken upptäcktes för några år sedan av folkskollärare E. Månsson och år 1948 närmare beskrevs av lektor E. Almquist (se Sv. Bot. Tidskr., Bd 42, s. 80).

Av icke obetydligt växtgeografiskt intresse äro fynden av *Sphagnum imbricatum* och *S. pulchrum* på *Erica*-lokalerna. Visserligen ha dessa vitmossor observerats (särskilt av docent H. Sjörs) på flera andra platser i Bergslagen än de nu nämnda, men i likhet med *Erica* ha *Sphagnum imbricatum* och *S. pulchrum* i Sverige sin förnämsta utbredning inom landets sydvästra delar. Också *Sphagnum molle*, som hör till samma utbredningstyp, har påträffats på den s. k. Lapplandsmyren, belägen 2,5 km söder om *Erica*-lokalen vid Dramboln.

Carl Malmström och *Gustaf Jönsson.*

Några iakttagelser över Uppsalatraktens Corydalis-former.

Corydalis-formerna i Uppsalatrakten äro intressanta genom sin stora variation, men särskilt därför, att vi här i det geologiskt sett unga landskapet ha en av dess få mer pregnanta endemiska former, *Corydalis »laxa»*.

På 1940-talet insamlade jag ett stort herbariematerial från viktiga lokaler till Växtbiologiska Institutionen i Uppsala. Det är huvudsakligen detta, som nu skall diskuteras, mina resonemang därtill bli mycket preliminära, särskilt som M. Ryberg, sedan detta skrevs 1949, kommit med vida mer djupplöjande analyser. (Min publicering har fördröjts för att ej fråntaga R. prioriteten.) Några tillägg ha dock nu 1953 införts med hänsyn till Ryberg.

I Linnés kollektivart *Fumaria bulbosa* inbegreps både *solida*-gruppen (*solida*, *laxa*, *pumila*) som a och *intermedia* (*fabacea*) som b (Flora suecica, ed. 2, 1755).

Sedermera urskildes allt flera former, ej minst österut i Eurasien. Vad vi nu kalla *laxa*, fick dock först sitt namn av Elias Fries i 3. delen av hans Mantissa, med typlokalen Upplands Steninge. Den anges där som mer bredflikig (latior) än *solida*. Hans son Thore Fries nämner dock intet härom i sin uppsats i Botaniska notiser 1854 (vilken huvudsakligen gäller hans nya »art» *rutacea*, som vi här kunna låta avsomna i frid). Senare författare, främst Thedenius, i sin flora 1871, angiva tvärtom *laxa* som smalflikig. Neumans uppsats i Botaniska notiser 1899 och mina herbariestudier i Herbarium Upsaliense och Herb. Uplandicum klara dock upp denna anomali.

Som bekant finns typisk *solida* vild i Finland. Den är där liksom på kontinenten storblommig, stor- och (framförallt) smalbladig. På Åland är den mera småvuxen och småblommigare samt minst lika smalbladig (ännu

mer än *pumila* i Uppsalatrakten). Denna *solida*-form finns nu enligt NEUMAN, a. a., i »Stockholms skärgård», och enligt mina herbariestudier på talrika lokaler i norra Roslagen. Längre inåt landet ha enligt NEUMAN genom hybridisering med *intermedia* uppkommit (fortfarande enligt N.) feta och klumpiga former (ett uttryck som inom parentes sagt bättre passat på NEUMANS skånska pigor). NEUMANS uttryck anser jag dock ej ens i sak vara riktigt. Tvärtom, stjälkens slankhet är typisk för Ekolns *laxae*. Tydligt är vidare, att THEDENIUS 1871 i stället beskrivit *laxa* efter exemplar från Roslagen (eller ev. Stockholmstrakten, där enl. RYBERG 1950 även dylik finnes). (Typlokalen Steninges *laxae* äro dock något litet intermediära.) I sin gradualavhandling framhåller ERIK ALMQUIST, att »i Mälartrakten leda fertila mellanformer över till *laxa*» (från *pumila*). LINDMAN återgår i sin flora (1:a och 2:a uppl.) till ELIAS FRIES' originalbeskrivning och avbildar alltså *laxa* bredflikigare än *pumila*. (*Solida*, vars smalflikighet dock ingen betvivlat, är ej avbildad här.)

Nu till mina egna iakttagelser i naturen. Dessa hänföra sig främst till 4 eller 5 lokaler söder om Uppsala: Nåntuna lund (Danmarks s:n), Fredrikslunds sjöhage (den vid herrgården, ej den vid Morga), dungarna vid Krusenberg (båda i Alsike) och lövängarna väster och nordväst om Haknäs (i Vassunda). Jag insamlade där, särskilt från Fredrikslund och även från Haknäs, praktiskt taget allra minst ett ex. av varje biotyp, som jag såg, något mindre från Krusenberg och intet alls från den i herbarierna rikt representerade Nåntuna lund. Inga ex. funnos i Uppsala från Fredrikslund och Haknäs tidigare (en del däremot från Krusenberg), ej heller äro lokalerna närmare berörda av RYBERG 1950 och 1951.

Och jag använde mina ögon, då ännu utan alltför mycken historiskt systematisk barlast. Särskilt intresserade jag mig självklart för bladformen, även under växtens början fruktifikation, samt för blomfärgen, för detaljerna i blomformen, knölar vid sporrpipen, urnupna kronblad osv. däremot mindre. De båda senare karaktärerna verkade dessutom stå i en klar och entydig relation till blomstorleken.

Nästan varje lokal har sin karaktär. — Vid Fredrikslund finns först och främst, vad ELIAS FRIES kallat *laxa*. Det är en relativt bredflikig, ej särdeles hög (men högre än *pumila*) och rätt spenslig form med slokande klasar av relativt få, glest sittande och mycket mörka blommor. Vidare finns här en relativt högväxt samt mer stor- och även smalbladig form (ehuru snarast något mindre smal än *pumila* här), med nästan rakt upprätt, mångblommig klase av rätt ljusa blommor, vilkas segel dock är mörkt (alltså typisk tvåfärgighet). Den liknar således åtminstone delvis den renare *solida* (se vidare nedan). — *Pumila* här har nästan enfärgade, svagt violettskära, rätt små blommor i täta, ganska mångblommiga, lutande klasar, är vidare lågväxt och rätt smalbladig. *Intermedia* är av vanlig typ, dock snarast småvuxnare än annars.

Många övergångsformer träffas, ehuru *intermedia* endast tycks hybridisera med *laxa*, vilket även ALMQUIST och RYBERG framhålla. Vidare såg jag då ett ex. av en grov, mycket underlig form med alldeles hela skärmblad, tydligen en helt sekundär utklyvningsprodukt, som verkligen motsvarar NEUMANS »feta och klumpiga» hybrider. Träffades den i större antal

vore den kanske en god art, åtminstone en underart, nu bör den väl bara anses som en extrem hybridtyp.

Krusenbergspopulationen innehåller särskilt talrika typiska *laxae*, få solidoider och en del *pumilae*, Nåntuna lund mycket *pumilae* (varför den ju ock varit känd åtminstone ända sedan Elias Fries' tid). Haknäslokalen vid sjön (den närmare Haknäs är mindre viktig) står till polymorfi ytterst nära Fredrikslund (dock kanske något mer *pumilae*?).

Parallellisera vi nu mina former med de erkända, äro ju *intermedia* och *pumila* genast klara, *laxa* motsvarar Elias Fries' ursprungliga *laxa* (enligt definitionen, ehuru något mera extrem till bladformen än typ-exemplaret), och den solidoida typen står i viss mån för sig. Bredden hos dess bladflikar ligger mellan *laxa* och egentlig *solida* (från Finland och Mellaneuropa) samt motsvarar ungefär *pumila*'s (i Uppland). Till blomstorlek står den något närmare *solida* än *laxa*, men blomfärgen är ljusare, som vore den en del av en gammal hybridserie, *pumila* × *solida* (varemot dock i någon ringa mån bladformen talar) — kanske ock luxurierande hybrider *pumila* × *laxa* (som Ryberg tycks anta hos liknande ff.). Formen från Åland och Roslagen står till blomstorlek mellan Ekolnsträndernas *laxae* och solidoiderna men är som sagt mycket smalbladig och med liksom typisk *solida* tämligen mörkt rödvioletta blommor (dock ej så mörka som *laxa*'s).

Här är naturligtvis odling och korsning, så som Ryberg nu håller på med, det enda riktiga. Ryberg (1950) finner ju ock på ett stort material, att alla de svenska arterna ha samma kromosomtal (2n = 16, undantagandes två rent aberranta individer).

För att i någon mån söka klargöra *Corydalis*-formernas inbördes relationer skola vi nu säga något om deras utbredning i Skandinavien. (Även nedanstående var skrivet redan 1949. Då det i vissa fall kompletterar Rybergs här dock mer preliminära utredningar av 1950 [och 1953], har det fått stå, med ett par små hänvisningar till hans resultat.) Här finns nu *pumila* främst utmed östkusten från Uppsalatrakten söderut men även i södra och delvis sydvästra Skandinavien. I Uppland är den överallt i genomsnitt smalflikigare än »*laxa*». Samma *pumila*-typ finns även i Skåne, Blekinge och Göteborgstrakten. Populationerna från Kalmar län och östligaste Blekinge, Vämö, äro däremot (som även Ryberg 1950 säger) mycket bredflikigare än t. o. m. Mälardalens *laxa*. Från städerna i Kalmar län finnas dock intermediära typer i herbarierna. *Solida* är överallt smalflikig (och något mer flikig i bladspetsarna än *laxa* och *pumila*, som härvidlag sammanfalla). I Skåne, där *solida* dock, trots flororna, väl måste vara vild i en del bergskogar i mellersta delen (t. ex. vid Brönnestad), är den lika storblommig som på kontinenten. (Intressant är nu att vi från ett ställe i S. Västergötland, Toarp, Stora Bygd, i H. Ups. ha ex. av den typiskt åländska formen — om den nu är vild där, vilket väl Westfeldt kan svara på. Den är tagen av en bekant botanist från trakten, Håkansson.) Dessutom finns som sagt den typiskt storblommiga *solida* i Finland och i en småblommigare varietet (v. *alandica*, n.) på några ställen i sydvästligaste Finland, på Åland och i norra Roslagen, från vilket en utbredningslucka (dock endast åt väster) skiljer den på Almquists kartor från Mälardalens *laxae*. (En kontinuerlig övergång ha vi kanske däremot via Stockholm och Ste-

ninge, se ovan, runt Upplandshalvön.) Denna smalbladiga form finnes också, ehuru något mindre typisk, enl. herbarierna även här och där i östra Södermanland.

Sedan ha vi ju de tidigare nämnda solidoida formerna med samma blomstorlek som Ålands *solida* men större örtstånd och blomskärmar, de senare kanske t.o.m. större än hos ren *solida*. Vi finna dem både vid Ekoln och i NÖ Södermanland, knappast annorstädes i Sverige. Kunde man nu, såsom Samuelsson på etiketter, tycks, och nu senast Ryberg, vilja, i dem endast se luxurierande typer inom den i alla händelser här individrika och polymorfa hybridserien *laxa* × *pumila*, vore kanske en del vunnet till förståelse av dessa växters systematik, ja utdifferentiering resp. invandring. Förmodligen ge oss Rybergs allsidiga undersökningar framdeles de rätta svaren härpå. Av mig angiven litteratur finnes noggrannare förtecknad hos Ryberg 1950 (och 1953), dvs. i Acta Horti Bergiani, Bd 15: 10 och 16: 7.

Tillägg. Vid en utflykt till Grisslehamn i maj 1952 med en del botanister såg jag talrika ex. av den åländska *solida*-formen, en del solidoider, lika dem vid Ekoln, och, samtidigt med Erik Almquist, även ett enda ex. av typisk *laxa* (detta senare dock vid en gammal fiskarestuga nära samhället).

Växtbiologiska Institutionen, Uppsala, 1949 och 1953.

Bertil Lundman.

Några notiser om Polygala vulgaris ad serpyllifoliam i Sverige.

Vid tillfälliga besök i Skåne 1920 (Röstånga, Ljungbyhed m.m.) och Bohuslän 1926, 1951 (Skaftölandet, Orust och Tjörn m.m.) träffade jag *Polygala*-former, som jag då bestämde till *P. serpyllifolia* enligt Lindmans flora, 1:a uppl. Sedan har arten strukits i Lindmans andra upplaga. Saken är sedan, såvitt jag kan se, ej alls diskuterad i svensk botanisk litteratur (även om Uppsalas »storbotanister», en Nannfeldt, en Hylander m.fl., på min fråga visade sig ha delvis lagt märke till förhållandet).

När jag nyligen närmare tittade på mitt exemplar från Röstånga, fann jag, att den tydligen viktiga karaktären hos *serpyllifolia* av motsatta nedre blad där saknades. För övrigt var exemplaret spensligt, med oregelbundet förgrenade stjälkar, fåblommiga blomklasar och blekblå blommor. Jag erinrar mig ännu med full visshet (vad som ju knappast mera med säkerhet kan iakttagas på ett herb.-ex.), att blomkölen hade vita fransar i spetsen, vilket Nordhagen kanske för första gången 1940 framhållit i sin norska flora. Både i V. Skåne och i Bohuslän träffade jag, jämte typisk *P. vulgaris*, även mångenstädes denna typ men endast på mer eller mindre utpräglad mossjord, vilket ju även skall vara fallet med äkta *serpyllifolia*. Parallellismen mellan biotop och ekotyp var också i detalj så fullständig, att även rent fenotypiska (ekofena) anpassningar måste spela en stor roll som ju ej sällan i dylika fall.

En genomgång av materialet i Uppsala-herbariet visade, att de svenska kollekter, som här kallas *P. serpyllifolia* (och synonymer), ävenledes sakna motsatta blad. Annars måste sägas att många exemplar (vare sig de i her-

bariet gå under namnet *P. s.* eller kallas *vulgaris* eller *vulgaris*-former) från södra och västra Sverige, åtminstone från Blekinge till Bohuslän, i övrigt habituellt starkt likna typiska västnorska och västjylländska ex. av äkta *P. s.* (En del småländska exemplar ha samma karaktärer mindre utpräglade och stå närmast *vulgaris*. Nomenklaturen för dessa typer är för övrigt rätt tilltrasslad, se något nedan!) Kollekterna från mellersta och norra Sverige, framför allt de talrikt förefintliga av *P. vulgaris* från Mälardalen, visa, jämte många egna iakttagelser ute i naturen, en mycket utpräglad och enhetlig ekotyp av *vulgaris* med många ogrenade, relativt grova stjälkar från rotstocken. Något liknande västkusttypen har jag aldrig sett i Uppsalatrakten, ej heller *P. vulgaris* växande på torvjord.

Även back- (och i extrema fall alvar-) ekotypgruppen, som i Neumans flora beskrives som var. *caespitosa* Persoon, träffades i åtskilliga kollekter från sydöstra Sverige (Skåne, Småland, Öland, Gotland). I vissa avseenden visar den sig, framför allt genom sina starkt greniga stjälkar, ha utpräglade *serpyllifolia*-karaktärer, men dess (i någon mån väl även fenotypiskt betingade) låga mattlika *Thymus serpyllum*-artade växtsätt kommer den att skilja sig från den äkta *P. serpyllifolia*. — Från västra Norge och från Jylland träffade jag i Uppsala-herbariet alla övergångsformer mellan fullt lika typisk *P. vulgaris* som i Mälardalen och lika typisk *P. serpyllifolia*, många alldeles lika våra mest *serpyllifolia*-artade typer, några andra representerande andra kombinationer mellan »stamarterna». Kanske är vår form en dylik övergångsform mellan arterna, vilken således som en »Halb-weise» skulle gå längre åt öster än den rena *serpyllifolia*, kanske blott en modifikation (ekofen), ehuru väl ej alldeles utan genetiskt underlag. Odling samt cytologiska och andra undersökningar borde väl dock göras före en ev. namngivning av formen.

Till slut ett par nomenklatoriska anteckningar. Lindmans var. *oxyptera* betecknar endast en variant beträffande blomformen. Langes var. *oxyptera* är däremot tydligen = Neumans subsp. *serpyllacea*. — Langes var. *compacta* = Neumans var. *caespitosa*.

Då, som sagt, nuförtiden svensk floristik (t. ex. den nya Göteborgs och Bohus läns flora) ej alls beaktat detta problem, vill jag fästa uppmärksamheten härpå. Mer är ej avsikten med denna notis.

Växtbiologiska Institutionen, Uppsala, 1953.

Bertil Lundman.

Selaginella selaginoides och Nymphoides peltatum i Östergötlands skärgård.

Från min pågående undersökning av flora och vegetation i Gryts skärgård i Östergötland, vilken delvis kommit att sträcka sig över angränsande områden, vill jag nedan redogöra för två nya växtlokaler. Dels torde dessa ha allmänt intresse, dels anser jag mig skyldig att åt professor J. A. Nannfeldt, som såg mig börja arbetet för flera år sedan och därefter med otroligt tålamod uppmuntrat mig utan synligt resultat, omsider få överräcka ett par växter från en skärgård, som han delvis gjort till sin egen.

Selaginella selaginoides (L.) LINK.

Lokalen för *Selaginella*, vilken jag fann 1951 och sedan tittat på de följande somrarna, ligger i Gryt s:n på Hässelön, strax intill Harstena by. På öns nordvästra långsida, mot Frännholmsströmmen, skjuter den ca 300 m långa, alltmer avsmalnande Hårviken in från NO mellan klippstränder, vilka längst in falla undan för ett sänkningsområde på ön, Dalen, som under tidigare skeden väl utfyllts i botten och nu löper vidare till öns andra kortsida i SV, klätt av rik tall- och granskog. I mötet mellan Hårviken och Dalen har på ena sidan utbildats en liten strandyta med delvis svålbundet finmaterial. Där står *Selaginella* spridd i strandängens allra översta del, på mark som i sin helhet dränkes endast under exceptionellt höga vintertransgressioner. Arten täcker en yta om endast 10 à 12 m längd och maximalt 5 à 6 m bredd, vilken senare kan krypa ned till någon halvmeter. Jag tror dock, att lokalen kan vara ganska typisk och kanske ger en fingervisning om var arten kan hittas på andra ställen i den sönderplottrade skärgårdsnaturen.

Hässelöns NV-sida utgöres nästan genomgående av isslipat men relativt burdust stigande berg med hällmarkstallskog, och detsamma gäller alltså för Hårvikens båda sidor. Genom Frännholmsströmmen pekar den indirekt mot stora vattenvidder i NO, och även om vågrörelsen i viss mån lugnas mot dess inre delar, kommer den dock genom sin utformning att verka som en tratt, genom vilken mycket både levande och dött driftmaterial föres vidare till den innersta, grundare delen. Multnande tång ligger där och gungar i fria vattnet också om somrarna, medan det mesta framförallt under vintern kastas upp mot de utplanade stränderna. På högra halvan — sett från ön den yttre sidan — är stranden utformad som en relativt smal stenskoning, över vilken driften lägges tjockt och endast ger rum för enstaka *Phalaris arundinacea*, *Festuca arundinacea*, eventuellt någon *Angelica litoralis*, *Sonchus arvensis* och *Atriplex latifolia*, varpå övervägande tallskog följer praktiskt taget oförmedlat. I vikens mitt vräkes driften upp över plana hällar i dagen eller täckta av ett tunt lager ackumulerat material, med enstaka *Phalaris*, eventuellt *Rumex crispus* o.a., varefter delvis mossartad skogsmark följer i Dalens botten. Vänstra — inre — halvan slutligen får mera lä av ett par i vattnet utskjutande berghällar, och en smal ridå av albuskar markerar bitvis högsta strandlinje, till vilken enstaka ungplantor av gran och tall gå ned från Dalen, som här sakta faller mot stranden från en närmast grytformad lid. Substratet i den utflackade stranden är relativt fint, med stenskärv, grus och sand hårt hopbakat och mörkfärgat av organisk substans. En täckande jordsvål är relativt väl utbildad från sommarens högvattenlinje och uppåt, men delvis är den åter sargad av vintrarnas påfrestningar. Spridda tångrester ligga genom hela profilen — inslaget av *Glaux maritima* är starkt, *Carex fusca* går karakteristiskt in omedelbart ovanför sommarens högvattenlinje och dominerar över *Festuca rubra* etc. —, men först i övre geolitoralen ligger driften tätare samlad. Detta högsta parti av stranden är lokalt utplanat på vissa ställen, på andra åter fortsätter stigningen jämnt med resultat att stranden snabbt övergår i den landbetonade marken. I förra fallet kommer vinterdriften att täcka ganska stora ytor, men relativt tunt, i det senare är den samlad till smala strängar.

Från år till år varierar vintertransgressionens höjd, och även en ringa förhöjning kan på de planare ytorna bredda det dränkta bältet ganska avsevärt, varvid den absolut landbundna vegetationen skjutes tillbaka. Effekten av en maximal transgression upphör icke på åtskilliga år, och den högsta, som ännu kan spåras som tångfragment i markytan och ännu tydligare i vissa vegetationselement, torde vara att hänföra till vintern 1949–50 eller ännu tidigare. Vid analys av växtmaterialet på mindre ytor allra längst upp kan intrycket bli skenbart förbryllande, men flertalet störande arter äro sådana som ganska snabbt invadera en svålbunden strands övre geolitoral. Reellt slutes den landbetonade vegetationen linjeskarpt ovanför högsta översvämmade parti med dominerande *Festuca ovina*, medan *Carex pulicaris*-äng med spridd *Selaginella* följer direkt nedanför denna. På den lilla ytan kunna dessa arter gå in i varandra, och *Sieglingia decumbens*, vilken ofta kommer till dominans i samma yta, talar då också om att föregående transgression ligger relativt långt tillbaka. Nedåt gå *Carex pulicaris* och *Selaginella*, m.l.m. starkt uppblandade med andra arter, till innevarande års högsta driftläge, genom vilket *Selaginella* alltjämt sticker upp i glesa förband, endast tången icke ligger för tjockt hopad; i vissa fall — och detta gäller framförallt intill de smala, koncentrerade tångsträngarna — går *Selaginella* ytterligare en bit nedåt, men aldrig långt. Den skyr sålunda icke tången på något sätt, utan vandrar nedåt i profilen med övriga arter, som gynnas av densamma. De vackraste exemplaren stå utan tvekan i direkt anslutning till årets driftsträngar, de tätaste grupperna en bit ned i de utplanade ytornas tidigare översvämmade partier, där spåren av tångtäcke nu äro så gott som utplånade.

Ytterligare en faktor, som torde vara av stor vikt, skall framhållas. Sippervatten från högre nivåer rinner praktiskt taget i ytan åtminstone under regnperioder, och det är möjligt att detta är kalkhaltigt. Berggrunden är genomgående kalkfattigt urberg, men i moränmaterialet kan ingå kalk från andra ursprungsområden. Den relativa artrikedomen högre upp i Dalen kan tala därför; i strandens allmänna vegetation finns eljest ingenting som gör detta nödvändigt. *Selaginella* står likväl på ett stycke mark, där vegetationen på sätt och vis ger en friskare bild än på andra strandavsnitt nedanför en sank skogsmark. Tången gynnar den säkerligen även direkt. Den jämna profilen skapar vidare en stor potentiell bosättningsyta, så länge höga transgressioner håller den fri från konkurrenskraftigare arter. I *Carex pulicaris*-ängen har den slutligen gott utrymme nära marken.

En översikt av strandens allmänna vegetation ges av bifogade profil från sommaren 1951, där provytor om 50 × 200 cm lagts ovanför varann från nedersta växtsamhälle (tab. I). Dess ursprungliga syftemål var emellertid ett annat än att belysa *Selaginella*'s uppträdande, och profilen har lagts över jämnt stigande strand, där *Selaginella* endast kunnat hålla en ojämn och hotad rand på baksidan av smala tångränder under albuskar. Profilen har heller icke förts ända upp till den verkligt landbetonade marken: *Festuca ovina* går in i den endast med yttersta utposter. — Ute i vattnet växte något *Potamogeton filiformis* och mera av *P. pusillus*. 1950–51 års vintertransgression var osedvanligt låg.

Provytor från sommaren 1953, om 50 × 50 cm, visa en artsamman-

Tabell I. Profil över vegetationen på svålbunden, sårad strand. Hässelön, Hårvikens innersta del mot Dalen. 12.8. 1951. Vattenståndet lågt.

Provytor om 50 × 200 cm. Siffrorna beteckna täckningsgraden inom sedvanlig 5-gradig skala, utbyggd med tecknet + för lägre täckning än 1. Förekommande unga trädplantor markerade endast till läget genom tecknet ○. Årsplantor av perenner, sterila exemplar etc. ha icke särskilts från övriga. Se vidare s. 241.

Provrutor och halvmeter	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Scirpus uniglumis	3	4	4	3	3		+	+										
Aster tripolium		1	2	3	1	1												
Triglochin maritimum				+														
Glaux maritima				1	2	3												
Plantago major v. *scopulorum*				+	1	3	2	2	1									
Juncus Gerardi					2	3	1											
Agrostis stolonifera					2	3	2	2	2	2	2	2	1					
Leontodon autumnale						2	3	2	2	1	1							
Plantago maritima						1	1		1		1	1						
Galium palustre						3	2	3	3	4	+	+						
Myosotis palustris							1	+										
Carex fusca							5	5	4	4	2	2						
Festuca rubra							2	+	1	2	4	3	2		2			
Linum catharticum							+	1	2	2	+		1	2			1	
Juncus articulatus								2	1	1	1							
Sagina procumbens								2	1	1	1	+	+					
Potentilla anserina								1	1	2			+	1				
Viola palustris								1	1	3	1	1	1	1	+	+	+	+
Triglochin palustre									+									
Sagina nodosa									+	1	+	+						
Trifolium fragiferum										+								
Lycopus europaeus										+	+	+	+					
Angelica silvestris										+	1	+		1		1		
Carex panicea										1	2	2	3		1		1	
Potentilla erecta										1	2	1	1	2	1	3		
Juncus conglomeratus												2						
Ranunculus flammula												1	1		1			
Agrostis canina												2	2	2		2		
Alnus glutinosa, juv.												○	○		○		○	
Sieglingia decumbens													3	4	3	1	4	3
Peucedanum palustre													+	+		+		
Carex Oederi v. *oedocarpa*													2	1	1		1	
Prunella vulgaris													2	3	3	4	1	1
Juncus effusus														2				
Filipendula ulmaria														2		2		
Carex pulicaris														1	1	+	2	3
Cirsium palustre															1			
Trifolium pratense															1			

Provrutor och halvmeter	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Ranunculus acris															2	2		
Pinus silvestris, juv.															○		○	
Cerastium holosteoides v. *vulgare*															1		+	
Selaginella selaginoides															1		2	2
Rumex crispus																+		
Sanicula europaea																+		
Senecio silvaticus																+		
Geranium robertianum																1		
Picea abies, juv.																○	○	○
Hieracium auricula																	+	
Viola canina																	+	
Galium verum																	1	
Festuca ovina																	2	3
Agrostis tenuis																		1
Nardus stricta																		1
Luzula multiflora																		1
Nakna driftränder (täckningsgrad)	5			1	1	2				2				1	1	2		

»Dagsdrift» — Sommar-drift — 1951. Sommarhögvatten — Vinterdrift 1950–51 — Vinter-drift 1949–50

Jordsvål

Höjdprofil från dagsaktuell vattenlinje

+ 70 cm

± 0 cm

sättning på mera utplanade ytor, som framgår av tab. II. Ytorna I–IV ligga i stort sett mellan de båda sista årens tånglägen, ytorna V–VI bakom dessa. Beteckningarna äro desamma som i den större profilen.

Hylander upptar i sin nya flora samma lokaler för Östergötland som en gång Kindberg i sin Östgöta flora: Kärna och Slaka, med reservationen »åtm. förr». Vare sig Hässelö-lokalen nu är den enda kända i Östergötland eller inte, torde den dock ha sitt största intresse som den sydligaste vid Östersjöns kust.

Nymphoides peltatum (Gmel.) O. K.

Syn.: *Limnanthemum nymphaeoides* (L.) Link.

Den nya lokalen för *Nymphoides peltatum* meddelades mig en av de sista dagarna i juli 1953 av direktör och fru Helge Gräslund, vilka funnit den under en båttur tillsammans med kommendörkapten och fru Percy Sköld. Den ligger i Sankt Anna s:n och under Missjö by, på det sydligaste av de skär, som i dagligt tal bära namnet Viskär, och detta har på nya ekonomiska kartbladet fått det egna namnet Kupan. Geologiska kartbladet upptar dess högsta punkt Kupaklint. Den yttersta tallskogen håller sig kvar i klapper och rasmaterial mot öppna havet under Kupaklint, medan den lägre S–SV-hälften är skoglös. Ungefär mitt på denna ligger gölen med

Tabell II. Artsammansättningen på typiska *Carex pulicaris - Selaginella*-ytor om 50×50 cm. Se s. 242–243.

Provyta	I	II	III	IV	V	VI
Agrostis canina		2	1	1		
A. stolonifera			1	1		
Alnus glutinosa (juv.)			1			
Angelica silvestris	1	1	1	1	2	1
Carex Oederi v. *oedocarpa*					1	
C. panicea	2	2	2	1	2	2
C. pulicaris	3	3	3	1	5	5
Cirsium palustre				1		
Festuca ovina					1	
F. rubra	2			1		
Filipendula ulmaria			1	1		
Galium palustre	1	+	+	1		1
G. verum	1					
Luzula multiflora				1		
Plantago maritima		1	1	1		
Potentilla erecta	2	2	2	1	1	2
Prunella vulgaris	1	1	2	3		2
Ranunculus acris	1			1	1	
Selaginella selaginoides	2	2	3	2	2	2
Sieglingia decumbens	2	1	1	1		1
Trifolium pratense			1			
Viola palustris	1	1	1	1	1	1

Nymphoides i bredaste partiet av en skärning som går tvärsöver skäret, med en längd av 15–20 m och en bredd av 12–15. Gölens nordsida har bitvis en smal strandskoning, vari rasmaterial ingår, men eljest stiger berget ganska brant till 6–8 m över dess yta, och gölen ligger alltså inpassad som ett slags stort hällkar. Djupet torde ingenstans uppgå till en meter; vattnet är gult humusfärgat och smakade inte salt, och mörkt slammaterial virvlar upp från botten vid minsta omrörning. Vid mitt besök låg vattenytan betydligt under avrinningströskeln, en sänka i den låga men breda häll, som omsluter gölens kortsida mot NO och utåt övergår i strandhällarna mot havet. Tröskeln torde ligga endast ca 1,5 m över sommarens normalvattenstånd men dock så högt, att de stora driftmassorna stanna på hällens mot havet vända sida. Den periodiska avrinningsytan om ett par meters bredd och djup lämnas alltså fri för en mera beständig vegetation.

Redan första intrycket av gölens vegetation var ganska bestickande. Följeväxterna hade jag sett förut under liknande förhållanden, men *Nymphoides*' flytblad, uppstickande gula blommor och i vattnet snett nedåtriktade frukter på isärspretande skaft kompletterade bilden vackert och stärkte i största allmänhet uppfattningen, att man inte ska låta sig över-

Fig. 1. Östergötland, Sankt Anna s:n, Missjö, Kupan. Gölen med *Nymphoides peltatum* från SV. — 30.7. 1953. Foto Axel Olsson.

raskas riktigt, vad som än dyker upp på ett nytt skär. Nära tröskelhällen och utloppet en rugge *Scirpus Tabernaemontani*; med koncentration till den rakt motsatta stranden men eljest glest utbredd över nästan hela ytan *Scirpus palustris*; likaså över praktiskt taget hela ytan gles–tätnande, grovvuxen *Hippuris vulgaris*, och slutligen över den eventuellt grundare och i varje fall solöppnare N–O-halvan *Nymphoides*, reellt täckande ca en fjärdedel av vattenytan. Typiskt stod den ihop med *Hippuris*, delvis också tillsammans med gles *Scirpus palustris - Hippuris*.

Tack vare den m.l.m. avbrutna strandskoningen på gölens N-sida omges denna där av fem stora alar mot en enda på S-sidan. Över avrinningsstråket står ett litet men tätt bestånd av småal med rönn och enbuskar strukna bakom sig, mot berget och gölsidan; vid skärningens förträngning på rakt motsatta ändan av gölen står också en rönn, en vacker *Rosa canina* och enar. Enar stå också bakom de stora alarna. Alltsammans ligger nedsänkt och relativt väl skyddat för vind, och det första intrycket av ankdamm eller skogsgöl snarare än ytterskärgård förstärkes. Vintertiden torde bjuda en bistrare aspekt. Speciellt vår och höst torde andfågel lockas av vattenspegeln.

Örtfloran i gölkanten är helt ordinär. På den delvis mossartade avrinningsytan fann jag sålunda *Carex fusca*, *Drosera rotundifolia*, *Empetrum nigrum*, *Eriophorum polystachyum*, *Lythrum salicaria*, *Phragmites communis*, *Potentilla palustris*, i strandskoningen under alarna förutom *Carex*

fusca, *Empetrum* och *Lythrum* även *Calluna vulgaris*, *Chamaenerion angustifolium*, *Deschampsia flexuosa*, *Dryopteris spinulosa*, *Festuca ovina*, *Lycopus europaeus*, *Rubus idaeus*, *Sieglingia decumbens* och *Solidago virgaurea*, och i den trånga, torrare passagen från gölens bortre sida *Chrysanthemum vulgare*, *Cynanchum vincetoxicum*, *Deschampsia flexuosa*, *Empetrum nigrum* och *Solidago virgaurea*, varefter passagen efter 12–15 m övergick i andra strandens *Filipendula ulmaria*, *Phalaris arundinacea* och *Scirpus uniglumis*. Runtom står berget grått och trist med enstaka enbuskar i skrevorna.

Sekreteraren i Östergötlands naturalhistoriska förening, fil. kand. B. Wahlin, Linköping, har på förfrågan meddelat, att *Nymphoides peltatum* troligen icke förekommer inom Östergötland för övrigt; han nämner arten som angiven för »Hällestad-ön» i Hällestad s:n, vilken uppgift han dock vill kollationera, innan han accepterar den. Lokalen på Kupan är icke ny såsom sådan: direktör Gräslund erfor vid samtal med en äldre skärkarl från trakten, att *Nymphoides*-beståndet sett likadant ut i hans ungdom. Hur arten kommit dit, är en annan fråga. Visst kan den vara kulturspridd; lustseglatser medförande m.l.m. romantisk inplantering kan ju ha förekommit även på 1800-talet. *Scirpus palustris* och *Hippuris vulgaris* synas mig typiskt fågelberoende i sitt uppträdande på andra skär långt ute till havs. Tills vidare vill jag alltså gärna tro, att *Nymphoides* kan vara fågelspridd till denna lokal.

Material av den *Scirpus palustris*, vilken ovan nämnts som dominerande över gölytan på Kupan, har granskats av förste museiintendent Harry Smith, Uppsala, och intendent Erik Asplund vid Riksmuseet. Enligt båda kan det insamlade materialet sägas tillhöra en *Sc. mamillatus*-härmande ras av *Sc. palustris*, med i viss mån karaktärer från båda arterna.

Göteborg i december 1953.

Axel Olsson.

Atriplex sabulosa i Halland.

Då jag den 20 september 1953 besökte havsstranden vid Åsa i Ölmevalla sn, Halland, fångades min uppmärksamhet av en påfallande ljus- och småbladig *Atriplex*, som växte tillsammans med *Atriplex glabriuscula* och *latifolia*. Jag kom ihåg, att jag hade sett denna typ här tidigare, troligen sedan flera år tillbaka, utan att egentligen reflektera över den. Då jag nu synade den, frapperade mig dess likhet med *Atriplex sabulosa*, sådan jag kände den från Jyllands västkust. Jag tog hem några grenar för kontroll. Perigonens och frönas egenskaper visade sig stämma med *A. sabulosa*. Men bladen var nästan hela och saknade sålunda i det närmaste den karakteristiska flikighet, som eljest vid första ögonkastet skiljer *sabulosa* från de andra hos oss inhemska *Atriplex*-arterna. Fil. dr Carl Blom har bekräftat, att fyndet gäller *A. sabulosa*. Att växten inte upptäckts förr på denna lokal, beror säkert på den extrema bladformen.

I Sverige hör *A. sabulosa* till de största sällsyntheterna. Om man bortser från några ruderatfynd, har endast ett enda exemplar anträffats tidigare — på Nordkoster 1943 av Gunnar Degelius. I Danmark uppträder arten sällsynt på Jyllands västkust. I Norge finns den på några punkter på sydkusten. (För utförligare uppgifter hänvisas till Degelius' uppsats i Svensk Botanisk Tidskrift 1944, s. 122.)

Den nyfunna svenska lokalen hyser ett hundratal individ utbredda över en ca 50 meter lång sandstrand.

Ivar Segelberg.

RECENSIONER.

Ronald Good, The Geography of the Flowering Plants. 2 uppl. — London - New York - Toronto 1953. 452 s. Pris 50 sh.

Som första upplagan (1947) av Goods handbok ej blev anmäld i SBT har det synts angeläget att ägna andra upplagan större uppmärksamhet än som eljest brukar komma en ny utgåva till del. I denna ha åtskilliga, delvis rätt avsevärda förändringar vidtagits, för vilka förf. redogör i sitt förord.

I »Introduction», där diverse elementära begrepp behandlas, definierar förf. »Plant Geography» som vetenskapen om växternas utbredning över jorden sedd ur rent floristisk-systematisk synpunkt med uteslutande av ekologi och sociologi men med hänsyn tagen till alla de förändringar i utbredningen som ägt rum sedan angiospermerna först uppträdde. Att gymnospermerna uteslutits är att beklaga och vållar svårigheter; förf. har vid karakteriserandet av sina floraregioner måst avstå från att nämna en enda gymnosperm.

I kap. 1 lägger förf. fram sitt förslag till jordklotets indelning i florariken och -regioner. Vi ha länge varit vana vid det system som återfinnes i Engler-Diels' Syllabus, och förf. har inte kunnat undgå att ta intryck av detta, men olikheterna äro stora. Englers 4 terrestra »Florenreiche» ha hos Good blivit 6 »Kingdoms» genom att sydvästra Kaplandet liksom hos en del andra förf. fått ett florarikes rang och Englers »Australes Florenreich» delats i två. Mot det ena av dessa, »Australian Kingdom», är väl intet att invända, men så mycket mera betänksam blir man vid bekantskapen med Goods »Antarctic Kingdom». I årtionden har ref. försökt få någon rätsida på användandet av termen »antarktisk» och har väl någon enstaka gång fått medhåll, men hos Good återkommer begreppet i en vidare omfattning än någonsin. Hans antarktiska florarike består av 3 regioner, Nya Zeeland, Patagonien + Eldslandet med Falklandsöarna och de tempererade sydoceaniska öarna, men utesluter den antarktiska kontinenten från all gemenskap med dessa; den saknar också på hans karta, pl. 4, varje beteckning. Före pleistocen fanns ett verkligt antarktiskt florarike, nu i splittrade rester representerat i en cirkumpolär, av både fastland och öar bestående zon, men eftersom Good icke avsett en indelning på paleofloristisk grund, så kan hans antarktiska florarike icke godtagas. Det är bättre att använda Englers term »austral», men i inskränktare bemärkelse, alltså med uteslutande av Australien; austral svarar mot boreal. Inom det australa florariket kunna regioner urskiljas och utan svårighet karakteriseras, t. ex.

en nyzeeländsk, en subantarktisk-cirkumpolär och en antarktisk. Den subantarktiska kan lätt delas i provinser, men till den hör icke Patagonien, och den linje förf. på sin karta dragit för att avskilja sin »Patagonian region» existerar ej i verkligheten. De arbeten där ref. särskilt diskuterat dessa frågor saknas i litteraturförteckningen, framför allt huvudarbetet av 1916.

Det paleotropiska florariket sönderfaller hos förf. i 3 underavdelningar, »subkingdoms», en afrikansk, en indomalajisk och en polynesisk, vardera uppdelad i ett antal regioner, som m.l.m. motsvara de englerska. De största förändringarna ha drabbat Englers »Monsungebiet», som ersatts med en kontinental sydöstasiatisk och en malesisk region, den senare i sina provinser nära anslutande sig till kartorna i Flora Malesiana; Englers »Araucarien-Provinz» har upplösts och dels överförts till resp. det australiska och antarktiska riket, dels fått bilda ett polynesiskt subkingdom. Genom att i detta sammanföra Nya Kaledonien och Hawaii med Melanesien-Mikronesien och Polynesien har man visserligen fått ett slags floristisk balans mot de afrikanska och indomalajiska områdena, men på verklighetens bekostnad. Varken Nya Kaledonien, Hawaii eller Melanesien kunna trivas under rubriken »Polynesian»; skall man urskilja ett tredje paleotropiskt subkingdom kan måhända Nya Kaledonien göra anspråk på en sådan ställning, medan Hawaii som en självständig region anslutes till den malajiska, inom vilka Melanesien och Mikronesien-Polynesien få bilda provinser.

Det boreala florariket har av naturliga skäl bearbetats mera ingående än de övriga, vilket förf. också själv framhåller, men facetteringen är dock vida längre driven hos Engler. Så sammanslår Good 6 av Englers alpina provinser i det mellaneuropeiska området till en enda, och endast Kaukasus erkännes som egen provins. F.ö. bjuder hela indelningen av det tempererade Eurasien på ganska stora omrangeringar, kanske inte alltid ägnade att tilltala skandinaviska växtgeografer, men en närmare utredning skulle kräva allt för stort utrymme. Jag skall bara tillägga att Englers »Arktisches Gebiet» benämnes »Arctic-subarctic Region», varvid subarktisk används i helt annan betydelse än hos Engler, vilkens »Subarktisches oder Coniferen-Gebiet» hos Good ej framstår som någon enhet utan tillsammans med resp. lövträds- etc. områden ingå i hans eurosibiriska, sinojapanska och nordamerikanska regioner. Den ledande synpunkten för Good har, säger han själv, varit urskiljandet av regioner, 37 stycken, som äro »roughly equivalent in floristic value and importance». Jämför man t.ex. hans »Pacific North American Region», som omfattar hela västra Nordamerika fr.o.m. Aleuterna och södra Alaska t.o.m. mexikanska höglandet, med hans av ett antal vulkaniska småöar och otaliga atoller bestående »Polynesian Region», så undrar man om hans strävanden alltid krönts med framgång.

I 3. kapitlet ger förf. några allmänna synpunkter på växtgeografien och understryker vikten av att städse ha »the evolutionary background» för ögonen. Begreppen polytopi, polykroni, släktens och arters livscykel, endemism och disjunktion klargöras, och naturligtvis ägnar förf. rätt stor uppmärksamhet åt Willis' Age and Area, vars egentliga betydelse han ser i den diskussion vartill den gav upphov.

Kap. 4–11 bilda första avdelningens huvudparti, nämligen framställningen av utbredningstyperna hos familjer, släkten och arter. Kap. 4 behandlar familjerna, som med den snävare begränsning förf. hyllar äro nära 400, vilka alla nämnas. Rubriker som »cosmopolitan and subcosmopolitan, tropical, temperate, discontinuous» antyda de utbredningstyper förf. urskiljer, och de gå i fortsättningen igen när det gäller släktena och arterna. Kartor meddelas av några påfallande disjunkta familjer samt över *Tropaeolaceae* som exempel på endemisk familj. Med tillfredsställelse noterar ref. den uppmärksamhet förf. ägnat södra halvklotets hittills underskattade roll som bildningshärd i stor skala. För att närmare illustrera några anmärkningsvärda utbredningstyper har förf. utvalt *Primulaceae*, *Palmae*, *Proteaceae*, *Lobeliaceae* och *Bambuseae* bland gräsen.

I kap. 5–7 genomgås släktena; förf. framhåller att när det är fråga om problem av global räckvidd släktena ge bättre utgångspunkt än arterna, och han anser att dessa tre kapitel höra till det viktigaste i hans bok. Antalet släkten uppges vara omkr. 12500. Léméés Dictionnaire har varit hans förnämsta källa vid den statistiska behandlingen. Efter gruppen Tempererade släkten har inskjutits »Other wide genera», vilkas areal är för liten för att kallas vare sig tropisk, kosmopolitisk eller tempererad, men för stor för att kallas endemisk. Vad antalet arter pr släkte beträffar, så visar statistiken rätt överraskande siffror: omkr. hälften av alla släkten består av 1 eller högst 2 arter, omkr. 470 sl., av dem 305 tropiska, av 100 arter eller mer, samt 14 av över 1000, med *Astragalus* som segrare med c. 1800. Monografiska bearbetningar kunna naturligtvis i åtskilliga fall komma att ge andra, troligen lägre siffror.

Så långt kap. 5; det följande är ägnat de disjunkta släktena, kompletterat med Appendix B, där de 758 som disjunkta ansedda släktena fördelats på skilda utbredningstyper, och illustrerat med tecknade växtbilder och arealkartor. De endemiska släktena omtalas i kap. 7. Begreppet är tänjbart; som endemiska betraktar förf. sådana släkten som äro inskränkta till en floraregion eller, om de förkomma inom tvenne, dock ej täcka större yta än den som motsvaras av regionernas genomsnittliga storlek. Det blir många endemiska släkten på det sättet, omkr. 10000. Materialet granskas region för region och antalet endemiska släkten inom vardera anges approximativt. Behandlingen av Sydamerika strandar på den otillfredsställande regionindelningen i de andina och patagoniska områdena. Förf. har fått en rest av c. 80 endemiska släkten, som vägrat att låta ordna in sig. Med en korrekt indelning torde deras inplacering ej erbjuda några större svårigheter. Kapitlet avslutas med ett viktigt påpekande: södra halvklotet äger dubbelt så många endemiska släkten som det norra, och tyngdpunkten för förekomst av släkten med mycket inskränkt areal ligger jämväl på det förra. Här spelar fördelningen av landytorna och mängden av öar in jämte den omständigheten att vi här finna de skingrade resterna av den antarktiska tertiärfloran.

Åt arternas utbredningsförhållanden ägnas kap. 8–11. Antalet kända arter uppskattar förf. till c. 225000. Förhållandet mellan yta och antal diskuteras ingående i anslutning till Symkiewicz, Wulff, Williams och Willis. En tabell visar för ett stort antal områden av mycket olika storlek och

beskaffenhet förhållandet mellan yta och artantal, dvs. arttätheten, varpå de förhållanden de anförda siffrorna bringa i dagen diskuteras. Till belysande av frågan om olika artutbredningstyper har förf. valt ut 8 stora släkten, som bearbetats taxonomiskt i modern tid (alla dock inte fullständigt), *Plantago*, *Juncus*, *Begonia*, *Dioscorea*, *Drosera*, *Viola*, *Rhododendron*, *Erica*, för att få fram olika grader av geografisk koncentration av arterna, och förf. frågar sig vad denna innebär. Han kommer fram till att en största koncentration inom ett visst område ej behöver betyda att släktet där har sitt urhem, vilket, utan att vara någon nyhet, förtjänade att framhållas och med väl utredda exempel illustreras.

Arterna analyseras och fördelas med hänsyn till sin utbredningstyp på samma sätt som tidigare familjer och släkten (kap. 9), och i kap. 10 går förf. igenom alla sina regioner med hänsyn till förekomsten av endemer. Han inser att »endemisk» här borde fattas i en trängre mening än för släktena men har avstått därifrån, emedan han är rädd för att detta skulle verka förvirrande på läsaren, vilket väl inte behövt bli fallet. Resultatet har blivit att över 90 % av alla arter äro endemiska i Goods mening. Åtskilliga anmärkningar kunna f.ö. riktas mot detta kapitel. Så citerar han för sin arktisk-subarktiska region icke Simmons' arbeten; med Hulténs är han, såsom framgår av referaten i kap. 9, väl bekant. Påståendet att Grönland »virtually» är det enda återstående nedisade området i Arktis behövde med tanke på Spetsbergens Nordostland och Franz Josefs land modifieras. Bland karaktärsväxterna i den östafrikanska steppregionen anföres *Hagenia abyssinica*, som hellre borde ha fått sin plats i den nordostafrikanska höglandsregionen och för resten är karaktärsträd även på de centralafrikanska vulkanerna. Av de för den hawaiiska regionen anförda karaktärsarterna skall väl *Edwardsia grandiflora* föreställa *Sophora chrysophylla*, den enda på Hawaii förekommande arten, och *Dianella odorata D. sandvicensis*; *Eugenia malaccensis* hör väl till de av infödingarna avsiktligt införda fruktträden. Att det på grund av den tilltagande importen av adventivväxter nu skulle vara svårt att avgöra vad som är inhemskt och vad icke kan ref. ej finna. Det är sant att adventivfloran tack vare de ytterst livliga förbindelserna med Amerika till större delen är av amerikanskt ursprung, men inte ens om man tar den med i beräkningen bör man skriva att »the affinity of the total flora to-day is more with the New World than the Old», ty det kan vilseleda en mindre uppmärksam läsare, och man önskar att förf. när han tidigare sagt (s. 129) att de två viktigaste elementen i Hawaiifloran äro det asiatiska och det amerikanska, av vilka det förra överväger, hade tillagt att det sistnämnda omfattar föga över 7 % av släktena. De anförda karaktärsväxterna i förf:s patagoniska region äro, som man kan vänta sig, en heterogen samling; att hitta *Nothofagus betuloides* och *Opuntia Darwinii* i samma fålla är dock minst sagt överraskande.

Kap. 11, där de disjunkta arterna avhandlas, inbjuder onekligen till kritisk granskning. Rent formellt sett äro naturligtvis alla arter disjunkta som förekomma inom 2 eller flera av icke alltför smala land- eller vattenytor skilda områden. Men tag t.ex. de subantarktiska öarna i Atlanten från Falklandsöarna till Kerguelen, så finner man det onödigt att tala om disjunktion hos en art, som förekommer på allesamman: den har nått sin

största möjliga utbredning, vilken är så sammanhängande som den kan bli. Svårigheter av taxonomisk art göra sig lätt gällande. *Nertera depressa*, numera enl. reglerna omdöpt till *granadensis*, framhålls av Good som »one of the most remarkable of all discontinuous species», men det är här helt visst fråga om skilda former, ännu outredda. Exempel på disjunktion Sydamerika–Nya Zeeland (resp. Tasmanien), sådana som *Enargea marginata*, *Lilaeopsis lineata*, *Epilobium junceum* eller *Aristotelia pedunculata*, vila på föråldrade och oriktiga uppgifter — varför inte i stället nämna sådana fall som *Ranunculus acaulis*, *Stellaria decipiens* eller *Hebe*-arterna? Den sydamerikanska *Lobelia anceps* är ej identisk med den afrikanska. Stor otur har förf. haft med sina bipolära arter: i samtliga anförda fall är det fråga om vikarier — vilket naturligtvis icke gör problemet mindre intressant. Verkligt identiska former i nord och syd har man, såvitt man hittills funnit, i exv. *Trisetum spicatum*, *Deschampsia flexuosa*, *Ranunculus cymbalaria* eller *Koenigia islandica*. De sista avsnitten av kapitlet behandla i korthet vikarierande arter, arter med extremt liten areal, de marina blomväxterna, mangroveflorans utbredning samt havsstrandväxterna, särskilt de tropiska.

Kap. 12 och 13 innehålla en ganska detaljerad framställning av den brittiska florans historia och utbredning. Här ingår en redogörelse för H. C. Watsons klassiska arbeten. I kap. 13, »The distribution of plants in an English county» (Dorset), en sammanfattning av förf:s »Geographical Handbook of the Dorset Flora» (1948), analyserar han floran inom ett litet specialområde ur synpunkten av vad han benämner de enskilda arternas »intensity of distribution» — ett läsvärt kapitel, där utbredningens detaljer sättas i samband med edafiska, lokalklimatiska m.fl. faktorer.

Slutkapitlet (14) i arbetets första, statistiska avdelning ger en översikt av jordens geologiska historia och de fossila florornas vittnesbörd om tidigare utbredningsförhållanden, med särskild hänsyn till den moderna bearbetningen av den engelska tertiärfloran (Reid och Chandler). Framställningen av istidernas inflytande och av den postglaciala utvecklingen är i förhållande till den stora betydelse som formalstrande perioder förf. tillägger dem synnerligen knapphändig. Här står dock en rik litteratur, ej minst skandinavisk, till buds.

Verkets andra, mera spekulativa avdelning är ägnad en analys av de faktorer som reglera växternas utbredning och vandringar, syftar m.a.o. till att förklara de förhållanden som i första avdelningen statistiskt belysts. Ett inledande kapitel (15) följes av särskilda framställningar av de klimatiska (16), edafiska (17) och spridningsbiologiska faktorerna (18) samt av de förändringar som under angiospermernas tillvaro ägt rum i klimatiskt (19) och geologiskt-geografiskt hänseende (20, bergskedjeveckning, fördelning av land och hav etc.). Alla dessa äro »naturliga» faktorer, som intet ha att skaffa med människans åtgöranden, vilka tas i betraktande endast för så vitt de kunna tjäna till att belysa de naturliga processerna.

Förf. erinrar om att förutsättningen för all spridning är förekomsten under växtens liv av ett rörligt stadium med från moderväxten lösgjorda spridningskroppar, »disseminules»; termen »diaspores», som väl knappast kan ha förblivit okänd för honom, är att föredraga ej minst ur internatio-

nell synpunkt. Vad det absoluta värdet av spridningsmekanismerna angår så fastslår förf. att vi ej ha några bevis för att arter, utrustade med dylika, ha större utbredning än sådana som sakna dem. Överhuvud har Good en välgörande nykter syn på spridningens effektivitet på stora avstånd, t.ex. vid befolkandet av isolerade öar; särskilt prisvärd är hans ringa uppskattning av den roll havsströmmar och fåglar spela. I beskrivningen av diasporernas morfologi och tillpassning till olika färdesätt har förf. följt Ridleys icke särskilt anbefallningsvärda handbok. Bland exemplen på »adhesive mechanisms» saknar man så pregnanta fall som *Acaena* och *Cenchrus* för att inte nämna vissa nyctaginacésläkten med diasporer så klibbiga att den stackars fågel som råkat ut för en *Ceodes* eller *Rockia* svårligen kan bli påhänget kvitt; det sitter ännu efter lång tid som om det fästs med Karlssons bekanta klister. Att förf. omtalar myrmekokorerna utan att på något sätt hänvisa till Sernanders grundläggande arbeten är bra egendomligt.

I kap. 19 omtalas de förändringar i klimaten på jorden, om vilka fossilfynden, dendrokronologien, arkeologien och historien vittna (i förbigående må påpekas att förf. ej observerat att den gamla föreställningen om den s.k. Österbygden som belägen på Grönlands östkust för länge sedan visats vara falsk). Pollenanalysens landvinningar ha redan refererats i kap. 12 och 14. Diskussionen om de alpina och arktiska florornas ålder skulle ha vunnit på en undersökning av den roll äldre, numera försvunna fjällkedjor kunna ha spelat. Slutligen upptar förf. frågan om den eventuella variationen i ekliptikans lutning och dess inflytande på växternas utbredning.

Av de geografiska förändringar (kap. 20), till vilka hänsyn måste tagas, förslå de bevisbara nivåförändringarna i geologiskt sen tid, bergskedjebildningen undantagen, inte på långa vägar för att förklara den bild florornas utbredning företer. Förändringar i fördelningen mellan land och hav av helt annan storlek måste, om man i likhet med förf. underkänner den transoceana spridningens betydelse, förutsättas ha ägt rum, rörelser i vertikal eller horisontell led eller en kombination av båda. För egen del stannar Good för den wegenerska teorien i dess av Du Toit modifierade form, och han tror att den, sedan ännu kvarstående svårigheter för dess antagande undanröjts, skall ge en allmänt accepterad lösning av växtgeografiens stora problem. Även Jolys teori, enligt vilken jordens inre värme som följd av radioaktiviteten ackumuleras till dess siman övergår i smält tillstånd med en rubbning av sialblockens läge som eventuellt resultat, varefter under värmeförlust siman åter stelnar och en ny cykel inledes, behandlas och Good ser i en kombination Wegener Joly den förklaring som bör kunna tillfredsställa biogeograferna. Senast en sådan revolution inträffade var under senare delen av tertiären. Good sammanfattar i 5 punkter de antaganden man måste göra för att driftteorien skall passa. Utan att gå in på någon diskussion av vare sig Joly, Wegener eller Du Toit vill ref. rikta uppmärksamheten på en enda punkt. Driftteorierna förutsätta bl.a. att polernas läge i förhållande till kontinenterna växlat, och Good menar att sydpolen ej kunnat ligga i centrum på Antarktis då denna världsdel ägde en rik växtlighet, emedan ljusbehovet under den mörka årstiden inte alls varit tillräckligt tillgodosett. Här må erinras om att talrika

fanerogamer reda sig gott på höga latituder på norra halvklotet och att stora delar av det antarktiska fastlandet ligger norr om 70:e breddgraden.

I kap. 21 framställer förf. den »Theory of Tolerance» som han 1931 offentliggjorde i New Phytologist. Växternas utbredning regleras av vissa faktorer, och stora förflyttningar av arter och floror ha ägt och äga fortfarande rum (i vår tid dock väsentligen iakttagbara endast såsom resultat av mänskligt ingripande, avsiktligt eller oavsiktligt). Dessa faktorer äro dels »inre», klimatiska, edafiska och spridningsbiologiska — vi bruka väl annars tala om dem som yttre — dels »yttre», periodiska klimatförändringar, omgestaltning av jordskorpans morfologi, förskjutningar av kontinentblocken, vilka kontrollera de verkningar de »inre» faktorerna medföra. Vi kunna föreställa oss orsakerna till växternas vandringar och konstatera deras verkan, men det återstår oss att förklara varför de haft denna verkan. Denna lucka vill Goods toleransteori fylla. Han uttrycker den i 6 punkter, av vilka jag nöjer mig med att citera den första: »Varje växtart kan existera och med framgång föröka sig endast inom bestämda klimatiska och edafiska gränser.» Denna amplitud är ett uttryck för artens tolerans. Denna sats var väl ej ens 1931 någon nyhet, och Good erinrar också om att toleransbegreppet återfinns hos många författare, men detta förringar inte betydelsen av den analys han underkastat frågans olika sidor, på vilka ett par exempel må lämnas.

För varje art existerar ett »största potentiellt område». Möjligheten att erövra detta beror primärt på spridningsmöjligheten, därefter på utsikterna att kunna hävda sig. Fullkomlig tolerans mot alla faktorer existerar ej, och det finns ingen i verklig mening kosmopolitisk art. Av stor vikt är skillnaden i tolerans mellan olika individ av samma art; somliga visa t.ex. större köldresistens än huvudmassan och säkra därmed artens bestånd inom ett område, där flertalet skulle falla offer för en plötsligt inträffande köldkatastrof. Här kommer dock frågan om raser och ekotyper in; förf. nöjer sig med att hänvisa till arbeten av Claussen och medförfattare (1940–48) men har egendomligt nog försummat att citera Turesson!

Än en gång återkommer förf. till Willis' Age-and-area-teori, som i kap. 3 närmare skärskådades, och upprepar vad andra sagt: att ett taxons mycket inskränkta area ej behöver ha något att skaffa med dess ålder; den kan ha nått den maximala utbredning dess tolerans medger, emedan den ställer speciella, svåruppfyllbara krav på ståndorten, osv. — »there seems little hope of deducing age from area».

Toleransteorien är, anser dess upphovsman, även av utvecklingsteoretiskt intresse. Man kan som bekant experimentellt framställa nya former, och klimatförändringar kunna ha samma verkan. Den långsamt fortskridande evolution, som pågått sedan livet först uppträdde, avlöses, anser Good, under de katastrofartade glacialperioderna av en vida snabbare artbildning, inducerad av klimatförändringen och givande upphov till nya former, var och en med sin egen toleransamplitud; det är nämligen ej sannolikt att två olika taxa ha precis samma krav. På de sista sidorna i kapitlet diskuteras acklimatisering och tillpassning till ny miljö enligt trädgårdsodlingens erfarenheter. Någon acklimatisering i populär mening existerar ej; att en art trivs i kultur, ja naturaliseras under förhållanden som

avvika från de i dess hemland rådande, beror på att den plats där den hamnat hör till dess potentiella utbredningsområde. I korthet avhandlas vernalisation och de växlande kraven på miljö under olika faser av individens liv, varvid särskilt ryssarnas forskningar uppmärksammats.

I slutkapitlet, som ger en översikt av verkets innehåll, har förf. närmare preciserat sina åsikter om istidernas revolutionerande inflytande. I preglacial tid rådde ett jämviktsläge mellan växterna och omvärlden. Detta jämviktstillstånd gick förlorat tack vare de förändringar som drabbade miljön och som utlöste en mutationsperiod under vilken alltfort nya former skapas. Växternas utbredning är så att säga flytande, en art kan bestå endast om utbredningen ändras i takt med förändringarna eller genom att modifieras genom och under tillpassning till dessa. Man skulle ha önskat att förf. gett konkreta exempel ur det material på vilket han byggt dessa spekulationer.

Litteraturförteckning på 629 nr, växt-, person- och sakregister fullborda volymen, som illustreras av 75 textfigurer, habitusbilder av växter och kartor, samt 25 tavlor, därav 9 världskartor visande klimatförhållanden, vegetations- och floraregioner etc.; de återstående tavlorna, utmärkta vegetations- eller växtbilder, av vilka åtskilliga äro gamla bekanta från annan växtgeografisk litteratur, ha knappast någon angelägen uppgift att fylla i ett arbete av denna karaktär men erbjuda onekligen ögonfägnad.

Ingen har rätt att vänta att en framställning som väsentligen bygger på uppgifter som hämtats från en ofantligt stor och snabbt växande litteratur skall vara felfri. Jag har ovan påpekat en och annan brist som uppkommit genom att förf. förbisett viktiga skrifter eller använt föråldrade källor. De ha gällt områden och floror, med vilka ref. råkat vara bekant. Jag kan tillägga att sl. *Reynoldsia* ej är endemiskt på Samoa + Tahiti utan har sin tyngdpunkt på Hawaii, att »*Carex uncinata*» i snart 150 år hetat *Uncinia* och ingenting har med *Carex* att skaffa och att *Microlaena stipoides* utan tvivel är i sen tid inkommen till Hawaii.

Ingen kan begära att förf. skall ha följt med våra dagars otaliga och ofta stötande namnändringar, men hans avsikt är nog att vara modern, han skriver *Delonix* (*Poinciana*) *regia*, och *Victoria* får inte heta *regia*, utan *amazonica*; det är då förvånande att han i st.f. de allmänt kända och sedan länge brukade *Gunnera chilensis* och *Fuchsia magellanica* använder *G. scabra* och *F. coccinea*. *Drosera longifolia* heter på ett ställe så, på ett annat *D. anglica*. Tryckfel synas vara ytterst sällsynta; dem ref. kommit på rättas härmed, ty de äro störande: *Plantago* »trimenta» skall vara *truncata*, *P.* »principis» *princeps* och *Nothofagus* »pumila» *pumilio*.

Det är väl troligt att andra granskare, hemmastadda på andra områden än ref., också ha en del anmärkningar i samma stil att komma med. De väga dock lätt mot arbetets stora förtjänster. Det är utomordentligt innehållsrikt, och den som snabbt behöver en uppgift rörande en familjs eller ett släktes utbredning söker sällan förgäves. Anhopningen av namn och data ge boken i viss mån karaktär av uppslagsbok, vilket inte hindrar att även dess första del med den statistiska behandlingen av materialet utan motvilja kan sträckläsas; förf. har nämligen förmågan att tack vare sin klara, väl genomtänkta framställning och utmärkta stil göra även ganska torra kapitel i hög grad njutbara. Detta skulle i ännu högre grad ha blivit

fallet, om i registret släktenas familjetillhörighet utsatts, där så varit behövligt. I texten nämnas massor av släkten, vilkas namn genomsnittsläsaren förmodligen ser f.f.g. Familjenamnet säger honom kanske inte så mycket, men i regel dock något, ifall han är hjälpligt orienterad i angiospermsystemet.

C. Skottsberg.

Symposium on Chromosome Breakage, held at the John Innes Horticultural Institution 9–11 June 1952. — Suppl. to Heredity, Vol. 6. Oliver and Boyd, London and Edinburgh, March 1953. 315 s. Pris 45 sh. eller 7.50 doll.

Föreliggande arbete innehåller 23 uppsatser skrivna av sammanlagt 24 författare samt är försett med ett företal av C. D. Darlington. Uppsatserna äro fördelade på fyra avsnitt: 1. Radiation breakage, 2. Chemical breakage, 3. Secondary and spontaneous breakage och 4. General.

Bland den första gruppens uppsatser intresserar speciellt undersökningar gjorda av Koller och Haque över effekten av låga röntgendoser utspridda över en längre tidrymd. För en dos av 200 r given i fraktioner om 0,5 r per minut påvisar Koller en ökning av antalet celldelningar jämfört med kontrollmaterialet. Normalt brukar annars röntgning medföra sänkt delningsfrekvens. I en studie över *Luzula purpurea*, vars centromer varit föremål för diskussion, framlägger La Cour sannolika bevis för förekomsten av ett polycentriskt centromersystem hos denna art. Avsnittet om »Chemical breakage» inledes med ett arbete av Friedrich Oelkers, nestorn när det gäller undersökningar över kemikaliers inverkan på kromosomerna. Oelkers påpekar att de substanser, som ge kromosombrott med en spridning, påminnande om de spontant uppträdande, äro oorganiska salter och nukleinsyrederivat. Tillfällig förekomst av dylika substanser i en växts vävnader bör kunna förorsaka kromosombrott. Detta kan vara en förklaring till de spontana mutationernas uppkomst. Av ytterligare intresse i detta avsnitt är en uppsats av Revell, som visar att brott företrädesvis orsakas i de heterokromatiska partierna av ett bestämt kromosompar hos *Vicia faba* vid behandling med vissa kemiska ämnen. Han bekräftar även ledes Fords tidigare gjorda iakttagelse att kemiska abnormiteter uppträda i högre frekvens hos små än hos stora kromosomer. I den allmänna avdelningen fångas intresset speciellt av ett arbete av Ambrose och Gopal-Ayengar över orienteringen av molekylerna i kromosomerna och med ledning härav gjorda spekulationer över tänkbara ställen för uppträdandet av kromosombrott. — Som av dessa fragmentariska exempel framgått innehåller arbetet mycket av aktuellt intresse. Måhända skulle man dock önskat en mera representativ samling forskare för diskussioner av så fundamental art som det här är fråga om; tysken Oelkers utgör nu den ende bidragsgivaren, som icke arbetar vid ett engelskt institut. Läsarens enda egentliga stötesten i det ovanligt väl redigerade och med talrika ypperliga fotografier, teckningar och diagram försedda arbetet utgör den yppiga flora av förkortningar av de mest skilda slag som utmärker uppsatserna.

Gör man emellertid i förtid upp en liten förteckning över förkortningarnas betydelser i resp. artiklar, blir läsningen av volymen ett nöje, som ingen av dessa spörsmål intresserade bör försumma.

Axel Nygren.

G. E. Fogg, The Metabolism of Algae. Methuen's monographs on biological subjects. London 1953. 149 s. Pris 8 s. 6 d.

Den serie, i vilken detta arbete ingår, påminner om den tyska serien »Sammlung Göschen». Trots ett behändigt fickformat är boken följaktligen mycket innehållsrik, beroende på ett koncentrerat skrivsätt och en föga utrymmeskrävande typografi. Serien omfattar hittills ett tjugotal arbeten inom botanik, zoologi och genetik.

Författaren, som är »reader» i botanik vid University College i London, anger noga all litteratur, varifrån uppgifterna är hämtade. Icke minst värdefull är följaktligen litteraturförteckningen med över 300 arbeten, där den, som önskar tränga djupare in i ämnet, har lätt att finna angreppspunkter på den omfattande litteraturen på detta område. Litteraturen har följts fram till 1952. Även enstaka engelska arbeten från 1953 finns citerade.

Begreppet alger använder författaren i mycket vidsträckt bemärkelse. Både *Euglenophyta* och *Cyanophyta* behandlas förutom de mer centrala grupperna. Till *Cyanophyta* räknas även en del former, som vi varit vana att betrakta som bakterier, såsom svavelorganismen *Beggiatoa*. Eftersom även ett par andra ur ämnesomsättningssynpunkt betydelsefulla grupper bland bakterierna omnämnes, kommer de flesta typerna av metabolism hos de lägre växterna upp till behandling. Algerna omfattar ju även några få klorofyllfria former.

I två omfattande kapitel redogör författaren för algernas energiupptagning och dess samband med assimilationen av kol. Indelningen i kapitel grundar sig här på energikällans typ, ljus eller kemisk energi. Vidare behandlas assimilationen av kväve i form av grundämne, ammonium, nitrat och organiska föreningar. Algernas behov av vitaminer och andra tillväxtfaktorer ägnas ett kort kapitel. De slutliga produkterna av algernas syntes behandlas, speciellt sådana ämnen, som är speciella för dem, såsom polysackariderna laminarin, algin, agar. I det sista kapitlet behandlas tillväxtkurvor för planktiska grönalger i kultur och de faktorer, som påverkar tillväxthastigheten. Vidare redovisas de förändringar i fråga om ämnesomsättningsprodukternas art som är påvisade i samband med tillväxtkurvans avvikelse från den exponentiella fasen.

Det lilla arbetet ger en god översikt av variationsrikedomen bland de lägre växterna i fråga om ämnesomsättningen och deras stora förmåga att anpassa ämnesomsättningen efter de yttre omständigheterna. Det bör vara till god hjälp för den, som önskar orientera sig i det arbete, som hittills är utfört på algfysiologiens område.

Sven Österlind.

Natur i Dalsland. Under redaktion av Nils-Gerhard Karvik och Kai Curry-Lindahl. — Svensk Natur, Stockholm 1953. 287 s. Pris 42: — kr.

Natur i Ångermanland och Medelpad. Under redaktion av Olof Elofson och Kai Curry-Lindahl. — Svensk Natur, Stockholm 1953. 392 s. Pris 46: — kr.

Även till julen 1953 lyckades Svensk Natur fullfölja sin tradition från föregående år att presentera den naturintresserade allmänheten två förnämliga landskapsböcker. I uppläggning och utstyrsel ansluta de sig till sina föregångare i denna förträffliga serie. Det må därför genast framhållas, att även den, som tar del av innehållet ur mera exklusiva botaniska synpunkter, ej behöver bläddra länge i volymerna för att finna stimulerande lektyr.

Dalsland är ett av våra minsta landskap men ingalunda ett av de minst intressanta ur botanisk synpunkt. Dess nordöstra del hör genom Hårds arbete av år 1935 till våra bäst kända områden betr. kärlväxtfloran. Till dem, som fortsatt hans arbete inom andra delar av landskapet, hör Gunnar Lohammar, och det är på honom lotten fallit att lämna den sammanfattande skildringen av landskapets växtvärld. I sin innehållsrika och överskådliga uppsats framhåller Lohammar florans västliga karaktär och belyser dess ställning genom instruktiva jämförelser med grannlandskapen. Läsaren förbluffas av att finna nordgränser för icke mindre än cirka 100 kärlväxter genomtvära eller tangera landskapet, en omständighet, som knappast kan förklaras genom någon klimatisk gränslinje genom detsamma. Några av dessa sydliga arter specialkarteras för landskapet och visa inom detta skilda utbredningstyper. I en särskild uppsats behandlar Lohammar landskapets märkligaste blomväxt, berglöken (*Allium senescens* v. *calcareum*), vars utbredning och ståndortsförhållanden han ingående studerat. Även Hugo Sjörs framhåller i sin uppsats över myrarna det västliga draget. Det kombineras emellertid med inslag av nordlig karaktär, och detta resulterar i för svenska förhållanden ganska unika myrsamhällen, vilket ger förf. anledning till några tänkvärda reflektioner över svårigheten att strängt klassificera våra växtsamhällen. I en andra uppsats ger oss Sjörs en levande skildring av Kroppefjäll, där han under två somrar gått på upptäcktsfärd över ängarna till gamla ödetorp, genom klyftdalar med suboceaniska mossor fram till agtjärnar och rikkärr, som bl. a. härbärgerade den tidigare för landskapet okända *Schoenus ferrugineus*. Men även andra delar av landskapet få sina botaniska särdrag belysta. I sina »Botaniska strövtåg mellan Vänern och Ärven» för oss Curt Mossberg till den intressanta växtligheten på skiffer och klorit, medan Olle Enbågen i trakterna kring Laxsjön låter oss möta en förnämlig samling av sällsynta orkidéer. Med Tore Hanson få vi exkurrera på de dalsländska vänerstränderna. Med sitt rika kulturhistoriska vetande visar oss slutligen Mårten Sjöbeck, hur Dalboslätten formats av kulturen.

Medelpad fick sin grundläggande provinsflora 1909 genom E. Collinder, medan för Ångermanland hittills endast spridda lokallistor och smärre växtgeografiska arbeten föreligga, vad kärlväxterna beträffar. Den under dessa förhållanden ingalunda lätta uppgiften att lämna en sammanfattande översikt av de båda landskapens flora har anförtrotts S. Grapengiesser, som löst den genom att trakt efter trakt anföra de floristiska särdragen. Brantbergen i Njurunda, uppmärksammade redan av Linné, Alnöns märk-

liga kalkflora, fjällväxterna på Rankleven, de ångermanländska kustbergen med deras botaniskt så märkliga rasbranter, allt detta och mycket annat passerar här revy. Genom Medelpad och Ångermanland nå åtskilliga växter med västlig utbredning längre österut än eljest, antingen i sammanhängande stråk eller med stora disjunktioner. Magnus Fries skärskådar de växtgeografiska problem, som här uppställa sig, och framhåller med särskild hänvisning till förhållandena här uppe under istidens slutskede den historiska faktorns betydelse. Eric Stefansson ger oss en översikt över skogarna med tonvikten lagd på skogstyperna och deras fördelning inom området. Sten Ahlner framhåller det starka alpina inslaget i det ångermanländska kustlandets lavflora. Gunnar Westman för oss till Tåsjöberget med dess berömda flora, medan Frans Bergvall demonstrerar orkidémyrarna vid Gideåberg. Från sin sjukbädd har Erik Modin delgivit oss sina minnen av nipsippan, som fått sitt namn efter de karakteristiska växtplatserna i Ramsele och Ådalsliden. Ångermanlands kustland har ägnats fyra uppsatser av botaniskt intresse: Gunno Hasselbergs »Växter vid havsstranden i norra Ångermanland», Alvar Nordströms »Skuleberget», Erik Evers' »Norafjärden och dess flora» samt Olle Söderströms »Om Härnösandstraktens flora». Även Medelpads kustland är lika frikostigt behandlat. Olof Elofson står här för den sammanfattande översikten, medan Ernst Schön skildrar Brämön och Karl Holm naturen vid Indalsälven. Ivar Segelberg botaniserar i Sundsvallstraktens *Viola*-flora, som har att bjuda på två sådana märkligheter som *V. collina* och *V. Selkirkii*.

Sten Ahlner.

John G. Dony, Flora of Bedfordshire. — Luton Museum, Luton, Beds. 1953. 532 s. Pris 42 s.

I Englands botaniska utforskande spela grevskapen samma roll som landskapen hos oss, nämligen att erbjuda den traditionella ramen för provinsfloror och växtförteckningar.

Bedfordshire är ett av de mindre grevskapen i mellersta England, beläget cirka 50 km åt NNW från London. Växtfynd från grevskapet figurera redan i landets äldsta botaniska litteratur, och den första lokalfloran utkom så tidigt som 1798. Nästa fullständiga förteckning publicerades 1911. Det ovan anförda verket är alltså den tredje sammanfattningen av grevskapets flora. Det har en för dylika arbeten ovanlig bredd och förtjänar utan tvivel att uppmärksammas även utanför de Brittiska öarna.

Förf., som är en av grevskapets egna söner och som 1941 förvärvade sin doktorsgrad på en avhandling om den lokala halmhattsindustriens historia, har under 18 år förberett sitt verk. Han har utfört sitt arbete med minutiös noggrannhet, och undersökningsområdets jämförelsevis ringa storlek (306 500 acres, motsv. 1 240 km²) har ju härvidlag varit en fördel. I själva verket har den areal, som han haft att inventera, varit betydligt mindre, då inemot 75 % av ytvidden intages av odlad jord, industriområden och bosättningscentra. Dock rymmer grevskapet fortfarande mycket av m.l.m. naturlig vegetation: bok- och ekskogar, dynområden, kärrängar etc. Många

arter, som tidigare uppgivits från Bedfordshire, äro emellertid numera helt utgångna här. Det som finns kvar av den naturliga vegetationen har förf. velat registrera med hjälp av utförliga ståndortsanteckningar från sammanlagt 86 olika, alltid exakt angivna punkter. Han har här influerats av Goods »Geographical Handbook of the Dorset Flora». För kännedomen om de allmännare arterna och deras frekvens vid tiden för undersökningen äro dessa anteckningar av stort värde. I många fall belysas de av utmärkta fotografier.

Florans speciella del behandlar ej endast kärlväxterna, även om avsnittet över dessa givetvis fått den största utförligheten. För släktet *Rubus* har förf. kunnat i sitt verk inkorporera W. Watsons arbete »The Brambles of Bedfordshire» (1948). Med hjälp av andra specialister ha även vissa kryptogamgrupper medtagits, nämligen blad- och levermossor, kransalger och svampar. Särskilt de senare äro emellertid ofullständigt utforskade, och förf. betraktar framställningen över dem närmast som ett appendix till den egentliga floran.

Sir Edward Salisbury, Kew, som själv exkurrerat i Bedfordshire, har skrivit ett företal till arbetet.

Sten Ahlner.

Kinnekulle. Berget som föddes ur havet. — Skrifter utg. av Biologilärarnas Förening, 1. Svenska Bokförlaget, Norstedts, Stockholm 1953. 107 s. + 4 bil. Pris häftad 5: — kr.

Kinnekulle har väl alltid räknats till de största sevärdheterna i vårt lands natur, alltsedan Olaus Magnus (1555) gav sin hänförda skildring av dess härligheter. Bilden av profilen genom den märkliga lagerföljden får varje svensk stifta bekantskap med redan i elementära skolböcker. Och för en botanist med floristiska intressen har det nästan ansetts som tillhörande den grundläggande utbildningen att någon gång ha vallfärdat till detta klassiska exkursionsmål.

En sammanfattande översikt av vad Kinnekulle har att bjuda på ur naturhistorisk synpunkt fyller utan tvivel ett länge känt behov. Det ovanstående arbetet innehåller också inom sitt begränsade omfång mycket nyttigt vetande, sammanställt av skickliga specialister. Kanske kan man beklaga, att det botaniska avsnittet fått nöja sig med endast 21 sidor mot 48 sammanlagt för de tre uppsatserna om den nutida djurvärlden. Rikard Sterner, som ensam svarar för det botaniska stoffet, har emellertid disponerat sin framställning så väl, att han faktiskt får med det mesta av det som gjort Kinnekullefloran berömd: det höga artantalet (beräknat till inemot 800, vad kärlväxterna beträffar), det starka inslaget av utpräglat kontinentala arter, många här med svensk nordgräns, rikedomen på eutrofer, särskilt i lundfloran, de relativt få, men intressanta rena kalkväxterna (fåtaliga, så länge man håller sig till kärlväxterna, bland mossor och lavar finnes — som förf. i korthet omnämner — denna grupp rikare representerad). Den ringa frekvensen av oligotrofer framhålles även. I uppsatsens

senare del skildras de klassiska växtlokalerna med Munkängen samt Österplana hed och vall som huvudnumren.

De 4 bilagorna innehålla kartor och profiler, bl. a. en geologisk översiktskarta i färg.

Sten Ahlner.

J.-G. Helmcke und W. Krieger, Diatomeenschalen im elektronenmikroskopischen Bild. I. — Bild und Forschung, Abt. Biologie. Transmare-Photo G. m. b. H., Berlin-Wilmersdorf 1953. 102 phot. Tafeln und Text. Preis DM 58. —.

Der anspruchslose Titel des Werks lässt dessen Bedeutung nicht vermuten. Schon bei der ersten Durchsicht des Atlas wird jedoch klar, dass es sich um eine der wichtigen Neuerscheinungen auf dem Gebiet der Diatomologie handelt. Die beiden Autoren — ein Physiker und ein Algologe, bekannte Fachleute auf ihren Gebieten — konnten durch ihre vorzüglichen Aufnahmen unsere Kenntnisse der komplizierten, meist ultramikroskopischen Strukturen der Diatomeenmembranen wesentlich erweitern.

Sämtliche Bilder des Atlas sind photographische Abzüge der Originalnegative; dadurch wurden alle Nachteile photomechanischer Reproduktionsverfahren von vornherein ausgeschaltet. Die Aufnahmen (102 Tafeln) sind mustergültig und die meisten stellen wohl das Beste dar, was bisher auf diesem Gebiet geleistet wurde. Die Bedeutung der Aufnahmen liegt nicht nur darin, dass bekannte oder als wahrscheinlich erkannte Einzelheiten klar und objektiv dargestellt wurden, sondern vielmehr in der Auffindung oder Erklärung von Dingen, die dem Lichtmikroskop unzugänglich sind und es bleiben werden.

Die Verff. benutzten zu ihren Studien nur Material, das durch H_2SO_4 von der organischen Substanz befreit war, und fanden durch vergleichende Untersuchungen, dass diese Methode im Vergleich mit anderen Verfahren die geringste Schädigung der Kieselmembran bedingt, was Ref. aus eigener Erfahrung nur bestätigen kann. In einigen Fällen, besonders bei der Untersuchung dicker, für den Elektronenstrahl undurchlässiger Membranen, wurde ein „Kohlehüllenverfahren" angewandt, das sehr gute Resultate ergab. In einigen Fällen konnten (wohl erstmalig? Ref.) photogrammetrische Messungen so feiner Gebilde wie Kammerstrukturen exakt vorgenommen werden.

Zum allgemeinen Verständnis der komplizierten räumlichen Verhältnisse mancher Membranelemente (wie z. B. von *Nitzschia*-Kielen und anderen Dingen, die aus den zweidimensionalen Aufnahmen nicht ohne weiteres hervorgehen) sind Rekonstruktionszeichnungen (von A. Bogen ausgeführt) beigefügt. Wenn diese manchmal in Einzelheiten auch etwas subjektiv erscheinen, so erfüllen sie doch ihren Zweck durchaus.

Auf einige interessante Darstellungen, die aus der Fülle der Einzelheiten herausgegriffen sind, soll kurz hingewiesen werden: Taf. 15–18 — Bau der Verbindungsstacheln bei *Thalassiosira*, Taf. 23–25 — Schalen, Zwischenbänder und Borsten bei *Chaetoceros*, Taf. 71 — Bau der „Hörner" bei *Navicula pygmaea* u. a. m. Die Leistung des von den Verff. benutzten Elektro-

nenmikroskops ist hervorragend, wovon die Darstellung der Siebmembranen bei *Pleurosigma angulatum* (Taf. 62) und *Amphora ovalis* (Taf. 77) zeugt. Bei einigen Objekten scheint selbst das hohe Auflösungsvermögen des Elektronenmikroskops nicht mehr ausgereicht zu haben, so z. B. bei den Schalenzeichnungen von *Chaetoceros* (Taf. 31, oder sollte die Siebmembran zerstört gewesen sein? Ref.) und einigen Membranen, denen man es ansieht, dass eine Struktur nur angedeutet, aber nicht aufgelöst ist.

Der Text ist knapp und kurz gehalten und beschränkt sich nach einer kurzen Einleitung im wesentlichen auf die nähere Erörterung der Aufnahmen. Eine Zusammenfassung der wichtigsten allgemeinen Ergebnisse wäre sehr wünschenswert gewesen; da es zu hoffen ist, dass das Werk fortgesetzt wird, ist es möglich, dass die Verff. dieses später beabsichtigen.

Das Werk ist gediegen und praktisch ausgestattet (lose Abzüge in Karton mit beigegebenem, etwas primitiven Stereoskop, das seinen Zweck nicht befriedigend erfüllt) und kann jedem Fachmann und Liebhaber der Diatomeenkunde nur warm empfohlen werden.

R. W. Kolbe.

J. Ramsbottom, Mushrooms & Toadstools. A study of the Activities of Fungi. — The New Naturalist. London (Collins) 1953. xiv + 306 sidor, 46 pl. i färg och 24 pl. i svart. Pris 30 s.

I den utomordentligt läsvärda »New Naturalist»-serien har ovanstående arbete varit bebådat sedan länge. Var och en, som känner förf:s allsidiga enorma kunskap om svamparna och hans förmåga att på ett medryckande sätt delge andra sitt vetande, har med spänning sett fram mot den dag, då arbetet skulle ligga på bokhandelsdisken. När det nu utkommit, måste man konstatera, att det bör tilltala varje naturintresserad och att det har mycket att lära även den verkligt kunnige mykologen, icke minst lärdoms- och kulturhistoriskt. Arbetet är ej en lärobok eller monografi, utan de olika kapitlen skildra begränsade problem och inskränka sig ingalunda till storsvamparna, som titeln kunde antyda. Hur nyckfullt utvalda kapitlen än kunna synas vara, ge de tillsammans en mycket god bild av svamparnas mångformighet, deras levnadsförhållanden och deras betydelse för människan och i naturens hushållning. Enda sättet att ge en föreställning om bokens innehåll är att i korthet nämna de olika kapitlen. I det inledande behandlas bl. a. namnen »mushroom» och »toadstool» (dvs. »paddstol»). (En serie dråpliga fotografier visar en padda, som tar säte på en rörsoppshatt!) Nästa kapitel behandlar de vetenskapliga namnens uppkomst och införandet av den linnéanska binära nomenklaturen. Ett annat ger svampkunskapens historia i korta drag från Theophrastus och Plinius till nutiden. Ett är ägnat åt svamparnas förekomst med särskilt framhävande av mögelsvamparnas intensiva aktivitet i tropikerna, något som de allierade vunno en dyrköpt erfarenhet av under andra världskriget. Det visade sig sålunda, att på Nya Guinea t. o. m. sådana föremål som kikare blevo förstörda efter några få veckor genom mögelsvampars inverkan och att instrument skeppade från Australien kunde vara obrukbara, innan de nått bestämmelsecorten. Två långa kapitel om giftiga och ätliga svampar inne-

hålla ej blott upplysningar om vad man fordom trodde om svamparna och deras giftighet utan även en noggrann genomgång av de giftiga svamparna, svampgifterna, deras kemi och toxiska verkningar. Följande avsnitt berättar om champinjonodlingen alltifrån dennas uppkomst i Frankrike under 1600-talet ävensom om odling av andra matsvampar. I några kapitel behandlas svampars tillväxt, sporproduktion, sporkaraktärer och könsförhållanden. Häxringarna ha fått ett eget kapitel, späckat med citat såväl från SHAKESPEARE och andra diktare som från gångna tiders vetenskapsmän men också meddelande forskningens senaste rön. Rhizomorfor och sklerotier är ett annat tema. Nästa rubrik är »mjöldryga och *Cordyceps*». Turen kommer så till ljusalstrande svampar, där honungsskivlingens mycel är det bäst kända exemplet. Åtskilliga andra finnas emellertid, icke minst i tropikerna, där på senare tid en del ganska starkt lysande arter upptäckts. En amerikansk krigskorrespondent kunde sålunda i ett brev från Nya Guinea berätta, att han satt och skrev i ljuset av fem hattsvampar. Några kapitel behandla morfologiskt särskilt egenartade svampgrupper, nämligen »röksvampar och jordstjärnor», »stinkmurklor och andra phalloideer», »brödkorgssvampar och återstående gastromyceter» samt »trytflar». Med tanke på de nyfynd som under senare år gjorts i Skandinavien av phalloideer sådana som *Anthurus* (= *Lysurus*) *australiensis* och *Dictyophora duplicata* (även den senare nu funnen i Norge, Blyttia 11, s. 135–138), är det av stort intresse att ta del av förf:s framställning om dessa och liknande arters uppträdande och sannolika historia i Storbritannien. Då förf. uppger, att även *Anthurus Archeri* skulle vara funnen i Sverige och Norge, är detta nära nog den enda oriktighet rec. anträffat i arbetet. Ett par kapitel äro ekologiska och behandla storsvamparnas förekomst på gräsmark, gödsel, kärrmark, sanddyner och i skogen. För dessa ståndortstyper lämnas långa listor över de allmännaste och mest karakteristiska arterna, vilka listor inbjuda till jämförelse med nordiska förhållanden. I detta sammanhang finner man ett kapitel behandlande mykorrhiza och övriga fastare förbindelser mellan svampar och andra organismer, såsom lavsymbiosen, symbioser mellan svampar och bakterier samt mellan svampar och insekter, och ett om hussvampen och andra husrötor. Slutkapitlet är ägnat en substans, som mer än någon annan väckt den stora allmänheten till insikt om svamparnas betydelse på alla livets områden, nämligen penicillinet. Allra sist komma en lång litteraturförteckning och ett utförligt register.

Bildmaterialet är som alltid i denna serie utomordentligt instruktivt och väl valt. Likaledes som vanligt äro reproduktionerna i svart-vitt förstklassiga, under det att färgbilderna lämna åtskilligt övrigt att önska ifråga om färgtrohet. Vi svenskar äro ju ovanligt bortskämda i dylikt avseende, men så betinga svenska böcker med färgbilder också helt andra priser.

Avslutningsvis vill jag uttala den förhoppningen, att det skall bli utgivarna möjligt att få andra kryptogamgrupper behandlade i serien på ett lika förnämligt och stimulerande sätt.

John Axel Nannfeldt.

SAMMANKOMSTER ÅR 1953.

Botaniska Föreningen i Göteborg.

Den 30 januari.

Fil. dr C. Blom höll ett föredrag om »Nyare fynd av adventivväxter i Göteborgstrakten».

Den 27 februari.

Professor B. Lindquist talade om »Japans flora och dess växtregioner».

Den 27 mars.

Notarie G. A. Westfeldt, Borås, berättade om »Kalkfloran i södra Västergötland».

Den 24 april.

Professor H. Osvald, Uppsala, höll ett föredrag om »Vegetationsbilder från Nya Zeeland».

Den 29 maj.

Demonstration av Botaniska Trädgården under ledning av professor B. Lindquist.

Den 29 september.

Dr H. Fries, folkskollärarna E. Carlsson, F. Karlvall och St. Nilsson berättade något om sommarens växtfynd.

Den 23 oktober.

Professor E. Hultén, Stockholm, höll ett föredrag »Genom de fagra riken. Botaniska strövtåg med färgbildskamera».

Den 27 november.

Professor B. Lindquist berättade »Något om vegetationen i västra Skandinavien under istiden».

Den förutvarande styrelsen omvaldes, nämligen prof. B. Lindquist (ordf.), lektor S. Sunesson (v. ordf.), apotekare S. Holmdahl (sekr. och kassör), lektor R. Sterner och folkskollärare St. Nilsson.

Exkursioner.

Söndagen den 31 maj företog föreningen sin vårexkursion i strålande väder till norra Halland under ledning av apotekare S. Holmdahl. Färden företogs med buss och privatbilar. Antalet deltagare var ca 50.

Den första anhalten gjordes vid Tölöberg utanför Kungsbacka, där den vackra förekomsten av *Potentilla rupestris* och *Geranium sanguineum* demonstrerades. Här växte även *Lathyrus niger*, *Vicia cassubica* och *Cotoneaster melanocarpa*. Färden fortsattes sedan genom Tölö sn förbi bergknallar täckta av vackert blommande *Sarothamnus scoparius* till Gåsevadholms slott, där Klas Alströmer i slutet av 1700-talet hade en botanisk trädgård. I och utanför parken blommade *Ranunculus cassubicus* rikligt.

Efter en snabbfärd till Åsa, 19 km söder om Kungsbacka, där deltagarna tittade på *Viscaria alpina*, som växte i klippskrevorna, ställdes färden norrut till Gröninge i Tölö sn, strax norr om Kungsbacka. Här intogs lunch i en backsluttning, och floran i den närmaste omgivningen studerades. Bl.a. antecknades följande arter: *Lathyrus niger*, *Campanula cervicaria*, *Carex montana* och *Vicia lathyroides*.

I Blixered (Släps sn) gjordes sedan ett kort besök vid en gammal fyndort för *Ononis repens*, och därefter styrdes kosan mot Vallda dalar i Vallda sn, där ett mycket vackert ekskogsområde demonstrerades av lektor R. Sterner. Här påträffades *Actaea spicata*, *Milium effusum*, *Polygonatum multiflorum*, *Adoxa moschatellina*, *Primula veris* m.fl.

På strandängarna, som skiljer området från havet, iakttogs *Carex recta* och *paleacea* och i en göl *Berula erecta*, *Glyceria declinata* och *Catabrosa aquatica*.

Vid en diskussion på stället om skötseln och vården av ekarna yttrade sig ägaren, ryttmästare H. Krafft, som välvilligt deltog som ciceron genom området, prof. B. Lindquist, lektor R. Sterner och stiftsjägmästare N. Ekberg.

Nästa och sista anhalt var strandområdet mittemot Onsala Sandö. Här besågs ett kraftigt exemplar av *Hedera helix*, som växte bland stenarna alldeles i strandkanten. På en strandäng fanns *Taraxacum balticum* och *Luzula congesta* och i en göl *Apium inundatum* och *Isoëtes echinosporum*.

Efter gemensam middag i Kungsbacka skedde därefter avresa till Göteborg på kvällen.

Söndagen den 6 september företog föreningen en exkursion till norra Hisingen och södra Inland. Färdledare var folkskollärare St. Nilsson. Antal deltagare 37 st.

Vid Skändla i Tuve sn demonstrerades en senglacial skalgrusbank med bl.a. *Taraxacum palustre* coll. och *Artemisia campestre*, båda arterna sällsynta i trakten. I närheten av banken växte *Euphorbia esula* och *Rubus serrulatus*.

I Norslätt (Säve sn) besöktes lokalen för den fridlysta *Sorbus aucuparia* × *intermedia*. I vattengölar i Nordre älvs gamla fåra vid Grimås i Rödbo sn konstaterades *Dryopteris cristata* och *thelypteris*, *Carex riparia* och *Hydrocharis*. Vid Kornhamns färjeläge i Säve sn fanns en rik förekomst av *Ser-*

ratula tinctoria. Här studerades också *Rumex aquaticus* och *hydrolapathum* samt hybriden mellan dessa arter. *Senecio aquaticus* uppträdde rikligt på strandängarna. I en ekdunge öster om Harestads kyrka växte *Melampyrum cristatum*.

En lund på östsidan av ett bergspartı vid Ranneberg i Torsby sn var dagens rikaste lokal med bl.a. följande arter: *Calamagrostis arundinacea*, *Milium*, *Festuca silvatica* (massförekomst), *Neottia*, *Cardamine impatiens*, *Vicia silvatica*, *Lathyrus vernus*, *Hypericum montanum* och *Campanula latifolia*.

Anthemis cotula och *Glyceria declinata* växte vid Bremmenäs i Lycke sn. Tofta i samma socken, som var slutmålet för utflykten, bjöd på *Zostera nana*, *Juncus alpinus* × *articulatus*, *Centunculus* och *Gentiana baltica*.

Botaniska Sektionen av Naturvetenskapliga Studentsällskapet i Uppsala.

Den 27 januari.

Till kassaförvaltare för 1953 valdes fil. kand. Angelica von Hofsten.

Fil. lic. Håkan Leyon höll ett föredrag med titeln »Några nyare rön beträffande kloroplasternas bildande och struktur».

Den 10 februari.

Agr. lic. Karl Lundblad talade över ämnet »Kulturväxternas bristsjukdomar».

Den 24 februari.

Agr. lic. Erik Eriksson höll ett föredrag med titeln »Något om svenska marktyper».

Den 17 mars.

Fil. lic. Börje Norén höll föredrag om »Myxobakterier — en föga känd bakteriegrupp».

Docent Magnus Fries visade bilder från ostafrikansk mangrovevegetation.

Den 24 mars.

Professor Eric Hultén berättade om »En resa på Öland i Linnés fotspår» samt visade talrika färgbilder.

Den 28 april.

Fil. dr Carl Olof Tamm höll ett föredrag med titeln »Tillväxt, produktion och näringsekologi i mattor av husmossa (*Hylocomium splendens*)».

Den 12 maj.

Till styrelse för det kommande läsåret valdes: ordf. fil. lic. Börje Norén, sekr. fil. stud. Karl-Göran Bringer, klubbmästarinna fil. stud. Gunvor Haage samt bildförevisare fil. stud. Erik Sjögren.

Den 14 maj.

Under ledning av laborator Gustaf Sandberg, agr. lic. Erik Eriksson och fil. mag. Eliel Steen företogs en exkursion till Norby lund och Fäbodarna sydväst om Uppsala.

Den 20 september.

Botaniska sektionen anordnade en exkursion med buss till Floran, det stora myrkomplexet 6 mil nordost om Uppsala. Ledare var amanuens Tord Ingmar.

Den 13 oktober.

Fil. lic. Olof Rune höll ett med talrika färgbilder illustrerat föredrag med titeln: »Botanisk resa i Finnmark».

Docent Nils Hylander demonstrerade en till Uppsalatrakten nyligen invandrad växt, *Galinsoga ciliata*.

Professor Ossian Dahlgren demonstrerade hybriden mellan krusbär och svarta vinbär.

Den 27 oktober.

Fil. lic. Karin Aschan höll ett föredrag betitlat »*Collybia velutipes* — fysiologisk-genetiska studier».

Den 17 november.

Docent Rolf Santesson höll ett föredrag över ämnet »Sentida förändringar i Skandinaviens havsalgflora». Ett rikhaltigt herbariematerial demonstrerades.

Docent Hans Luther, Helsingfors, höll ett kortare föredrag betitlat »Heterokontordningen *Vaucheriales* Bohlin».

Fil. mag. Per-Olof Lindahl redogjorde för några märkligare lavfynd i västra Norge sommaren 1953.

Den 24 november.

Docent Gunnar Lohammar och laborator Wilhelm Rodhe berättade om »Kongressresor på Brittiska öarna». Talrika bilder i svart-vitt och färg beledsagade föredraget.

Den 8 december.

Förste bibliotekarie Arvid Uggla höll ett föredrag över ämnet »Linné och England».

Botaniska Sällskapet i Stockholm.

Den 17 februari.

Professor Carl Malmström lämnade en kort historik över Sällskapet, »Botaniska Sällskapet i Stockholm 70 år». (Se Sv. Bot. Tidskr., Bd 47, H. 2, 1953.)

Fil. lic. Gustaf Sandberg talade om »Vegetationsekologiska strövtåg i Abisko-fjällen».

Den 5 maj.

Assistent JAN TENGNÉR visade »Blom- och vegetationsbilder från Stockholmstrakten».

Professor CARL MALMSTRÖM redogjorde för »Botaniska Sällskapets i Stockholm kommande arbetsuppgifter».

Den 17 maj.

Exkursion till Ängsö nationalpark. (Se Sveriges Natur, Årg. 44, Nr 3, 1953.)

Den 14 juni.

Exkursion till Kolmården. (Se Sv. Bot. Tidskr., Bd 48, H. 1, 1954.)

Den 12 september.

Svampexkursion till södra Djurgården. (Se Sv. Bot. Tidskr., Bd 48, H. 1, 1954.)

Den 27 oktober.

Professor FOLKE FAGERLIND höll föredrag om »Galapagosöarnas växtvärld».

Den 1 december.

Professor CARL MALMSTRÖM höll föredrag om »*Erica Tetralix* L. i Västmanland».

Docent ERIK RENNERFELT visade »Bilder från en skogsbotanisk exkursion på Sicilien».

Styrelse och revisorer omvaldes.

Botanistklubben vid Stockholms Högskola.

Den 10 februari.

Cand. rer. nat. DITER v. WETTSTEIN höll ett föredrag om »Framställning av stråstyva mutanter hos korn».

Den 6 mars.

Fil. dr NILS DAHLBECK gav några »Glimtar från Venezuelas flora och vegetation» och illustrerade sitt föredrag med färgbilder.

Den 13 april.

Fil. lic. CARL OLOF TAMM höll ett autoreferat om »Tillväxt, produktion och näringsekologi i mattor av en skogsmossa», och därefter visades några botaniska skolfilmer.

Den 21 oktober.

Förrättades styrelseval, varvid hela styrelsen omvaldes. Dessutom utökades densamma med en representant för årets kurs, och till detta valdes fil. stud. BARBRO GUSTAVSSON.

Docent Erik Rennerfelt och fil. stud. Allan Klingström talade »Om skadesvampar på våra skogsträd».

Professor Folke Fagerlind visade en serie vegetationsbilder i färg från nordvästra Australien.

Den 12 november.

Docent Gunnar Harling höll ett föredrag om »Embryosäckens utveckling hos *Vittadinia*».

Fil. stud. Hampus Arnell höll ett föredrag om en morfologisk undersökning av bladmossornas sporer.

Efteråt visades en serie färgbilder från sommarens gotlandsexkursion.

Den 14 december.

Fil. stud. Göran Wibom kåserade under rubriken: »Kors och tvärs över ekvatorn» och visade ett stort antal färgbilder från en halv världsomsegling.

Societas pro Fauna et Flora Fennica.

Den 7 februari.

Prof. I. Hustich föredrog: »Vildmarkerna försvinna, reflexioner mot bakgrunden av några resor i Kanada».

Prof. A. Luther uppläste minnesord över Sällskapets korresponderande ledamot, prof. Robert Lauterborn.

Upplästes minnesord över Sällskapets korresponderande ledamot, prof. Harald Blegvad, författade av prof. T. H. Järvi.

Till korresponderande ledamot valdes prof. E. Jorpes, Karolinska institutet, Stockholm.

Doc. Hans Luther hade till tryck inlämnat: »Fennoskandiens gräns i Vita havet». I arbetet uppmärksamgöres bl. a. på Solovetsk-öarnas oklara ställning med avseende å deras tillhörighet till Fennoskandia.

Prof. R. Tuomikoski framlade exemplar av *Dryopteris continentalis*. Arten var påvisad från Fjärrkarelen, Kuusamo och Salla.

Den 7 mars.

Prof. A. Palmgren redogjorde för sitt förslag till fredningsbestämmelser för Ålands växter och uppläste Statens Naturskyddsinspektörs till Ålands Landsting riktade utlåtande om detta förslag.

På doc. H. Luthers vägnar inlämnades till tryck en avhandling om den för Fennoskandia nya *Vaucheria arrhyncha*.

Den 11 april.

Prof. Anatol Heintz, Oslo, höll ett föredrag: »Utviklingslæren og Lamarckisme».

Mag. L. Fagerström hade för tryck insänt: 1. »Växtfynd i sydvästra Tavastland II»; 2. »*Selaginella selaginoides* (L.) Lk och *Carex oedocarpa* (Ands.) funna i Sa, Mäntyharju»; 3. »*Rosa mollis* Sm. och *Vicia tenuifolia* Roth i Terijoki».

Den 2 maj.

Prof. M. J. Kotilainen uppläste minnesord över doc. T. J. Hintikka.

Prof. R. Collander höll ett föredrag: »Vad elektronmikroskopet avslöjat om växternas finstruktur».

Prof. A. Luther delgav på doc. Hans Luthers vägnar Sällskapet innehållet i en artikel: »*Hildenbrandia rivularis* in Südfinnland angetroffen».

Dr Holger Törnroth meddelade om fynd av den för landet nya hybriden *Scleranthus annuus* × *perennis* i Eckerö, Åland.

Mag. L. Fagerström hade insänt för tryck: 1. »Lavar från norra Veckelaks (Vehkalahti) i Karelia australis»; 2. »*Umbilicaria pustulata* funnen i Humppila (sydvästra Tavastland)»; 3. »Nya fynd av *Calicium deminuens* Vain.».

Årsmötet den 13 maj.

Doc. Hans Luther hade insänt för tryck: »Weitere Beobachtungen über *Tetramyxa parasitica*».

Doc. H. Buch anmälde för tryck: 1. »Om utbredningen och spridningen av *Fissidens Julianus*, *Ricciocarpus natans* och *Riccia fluitans* i Östfennoskandia»; 2. »Tvenne för Östfennoskandias flora nya levermossor, *Riccia canaliculata* Hoffm. och *R. rhenana* Lorb.».

Prof. A. Palmgren inlämnade till tryck: »Bidrag till Ålands flora».

Mag. Etel Kalela inlämnade till tryck: »Über die Land- und Wasserform bei *Drosera*».

Från prof. I. Györffy inlämnades till tryck: »Über den Geo- und Phototropismus des *Sphagnum*-Pseudopodiums».

Efter förrättat val konstaterades Styrelsen hava följande sammansättning: ordförande prof. Alvar Palmgren, viceordförande prof. T. H. Järvi, sekreterare doc. L. von Haartman, skattmästare direktör Sten Stockmann, bibliotekarie dr K. O. Donner, ledamöter prof. P. Palmgren, prof. E. Häyrén, prof. Harald Lindberg, prof. R. Collander, prof. A. Luther, med prof. I. Hustich och doc. C. E. Sonck såsom suppleanter.

Den 3 oktober.

Framlades Sällskapets Memoranda vol. 28, innehållande förhandlingarna under verksamhetsåret 1951–1952. Redaktör hade varit mag. Holger Ahlqvist.

Prof. E. Häyrén inlämnade till tryck: »En för Finland ny blågrön alg, *Fischerella ambigua* (Näg.) Gom., från Korpilahti socken, Tavastia australis».

Mag. Lars Fagerström inlämnade till tryck: »Emil Graeffe och hans herbarium».

Dr Holger Törnroth meddelade följande växtfynd, gjorda av honom sommaren 1953 i norra Hammarland, Åland: 1. *Liparis Loeselii*, tidigare i Finland känd endast från Åland, Eckerö Storby, där den upptäcktes 1951 såsom ny för landet; 2. *Cladium mariscus*, tidigare i Finland känd från en lokal på Åland, Eckerö (1947, ny för Finland), och en lokal i norra Savolax, Jorois (1949); 3. *Schoenus ferrugineus*, tvenne nya fyndplatser ej långt från den plats, där doc. A. L. Backman fann arten någon vecka tidigare såsom ny för Åland.

Den 7 november.

Prof. I. Hustich delgav ett antal iakttagelser om den ovanligt varma vårens och försommarens samt höstens inverkan på växt- och djurvärlden samt uppmanade till insamling av liknande iakttagelser.

Prof. E. Häyrén meddelade resultaten av en sjöundersökning och inlämnade till tryck: »Kaukelanjärvi vid Harju i Padasjoki, Ta, rubbad ur jämviktsläget».

Apotekare B. Färdig redogjorde för fynd av *Lathraea squamaria* i Sibbo socken, Nyland, den östligaste hittills kända fyndorten i Finland. — Doc. C. Cedercreutz meddelade om utbredningen i Estland.

Den 24 november.

Extra möte, gemensamt med Vanamo-Sällskapet och Limnologiska föreningen. Prof. Sven Ekman, Uppsala, höll ett föredrag: »Undersökningar över kräftdjursplankton i norra Lapplands fjälltrakter».

Den 5 december.

På förslag av doc. Hans Luther och med förord av Styrelsen beslöt Sällskapet ändra namnet på den naturalhistoriska provinsen Kuusamo till Regio kuusamoënsis, med samma förkortning som tidigare.

Doc. Hans Luther hade ytterligare fäst Sällskapets uppmärksamhet på dragningen av Fennoskandias östgräns i Vita havet, närmast med avseende å Solovetsk-öarna, vilka på kartor i Sällskapets Memoranda hänförts till Karelia pomorica, och beslöt Sällskapet, på Styrelsens förslag, att återgå till den tidigare av A. K. Cajander dragna gränsen, som lämnar sagda öar utanför Fennoskandia.

Ordföranden erinrade om lektor B. Olsonis förfrågan angående stavsättet för provinsnamnet Ostrobottnia. Beslöts bibehålla det här använda gamla stavsättet.

Prof. Alvar Palmgren framlade första delen av dr Nils Hylanders Nordisk kärlväxtflora och skisserade upp bakgrunden till denna floras tillkomst, varvid tidigare floror av samma omfattning refererades. Dr G. Marklund redogjorde för den nya florans form och innehåll. Sällskapet beslöt sända en lyckönskan från mötet till dr Hylander.

Prof. Alvar Palmgren redogjorde för förekomsten av *Cardamine flexuosa* på Lövdal i Jomala socken, Åland. Arten har där under senare år starkt minskat på grund av tilltagande överväxning av den övriga vegetationen. — Förevisade jämväl exemplar av *Lepidium neglectum* från Mariehamn.

Å dr T. Branders vägnar anmäldes till tryckning tio avhandlingar, däribland tvenne av botaniskt innehåll: 1. »Försök med *Verbascum*-frön»; 2. En avhandling om zookori.

Svenska Växtgeografiska Sällskapet.

Den 17 april.

Sällskapets årsmöte. Styrelseval. Styrelsen omvaldes i sin helhet. Ordf. hyllade minnet av folkskollärare Nils Grimvall, Göteborg.

Föredrag av professor B. Lindquist: »Regionala drag i Japans vegetation.»

Sällskapet har under året utgivit följande band av Acta Phytogeographica Suecica: nr 31, O. Rune, Plant Life on Serpentines and Related Rocks in the North of Sweden; nr 32, P. Kaaret, Wasservegetation der Seen Orlången und Trehörningen; nr 33, T. E. Hasselrot, Nordliga lavar i Syd- och Mellansverige (Nördliche Flechten in Süd- und Mittelschweden).

SVENSKA BOTANISKA FÖRENINGEN.

Föreningens sommarexkursion till Kolmården 1953.

Vid 9.30-tiden på morgonen avgick lördagen den 13 juni från Stockholm den förhyrda buss, som skulle föra deltagarna i Svenska Botaniska Föreningens och Botaniska Sällskapets i Stockholm gemensamma sommarexkursion till färdmålet i Kolmården. Efter anslutning av ytterligare deltagare längs färdvägen fick den slutliga deltagarlistan följande utseende: trädgårdsmästare N. Asplund, Eskilstuna, stationsinspektor G. Dalhielm, Ockelbo, civilingenjör G. Een, Bromma, läroverksadjunkt I. Fröman, Nacka, civilingenjör E. Genberg, Norrköping, docent G. Harling, Lidingö, lektor A. Hedelius, Stockholm, banktjänsteman A. Johansson, Stockholm, kammarskrivare J. Knöppel, Lidingö, kamrer P. Olrog, Stockholm, ryttmästare Th. Olrog, Oxelösund, amanuens E. Pettersson, Stockholm, trädgårdsmästare O. Sandberg, Sollentuna, civilingenjör B. Segring, Vrena, assistent E. Söderberg och fru Clary Söderberg, Stockholm, herr G. Tholander, Borlänge, tjänsteman K. W. Troselius, Stockholm, fil. kand. B. Wahlin, Malmslätt, direktör A. Wennerberg, Göteborg, fröken Lilleba Vide och fru Vanja Vide, Stockholm, advokat F. Widstrand, Södertälje, samt agronom I. Wålstedt, Linköping, summa 24 personer.

Under färden söderut gjordes lunchpaus strax nordöst om Nyköping, och från nämnda residensstad togs också en liten avstickare österut till Linudden, sedan gammalt berömd för sin botaniska rikedom. Under ledning av ryttmästare Th. Olrog genomströvades området under någon timmes tid, innan färden ställdes mot Kolmården. Föreningens mångårige exkursionsarrangör Ingmar Fröman passade därvid på att förevisa den förnämliga umbellaten *Pleurospermum austriacum*, som har flera växtplatser i omedelbar närhet av riksväg nr 1 vid Vreta i Kila socken. Eftersom arten är fridlyst i Östergötland men icke i Södermanland, passade en och annan på att förse sig med exemplar för herbariet.

Vid länsgränsen till Östergötland mötte östgötavärdarna, civilingenjören Erik Genberg och fil. kand. Bertil Wahlin, vilken sistnämnde hälsade färddeltagarna välkomna till det fagra Östergyllen. Den pittoreska ruinen av Krokeks ödekyrka lockade deltagarna ett stycke på avvägar, men snart var man åter samlad på botanisk mark, närmare bestämt ett litet komplex av *Sphagnum*-mossar mitt uppe i Kolmården. Här kunde man studera det relativt artfattiga mosse-plancts växtsamhällen med

Drosera-arter, *Andromeda* osv. Såsom ny för just denna del av Krokeks socken antecknades *Luzula pallescens*; i övrigt erbjöd artlistan inga nyheter (jfr GENBERG 1951).

Före den väntande middagen på Skogsvikens pensionat i Krokek, där nattkvarter hade ordnats för resenärerna, företogs under ingenjör GENBERGS ledning en vandring på den kalcithaltiga, skogklädda Orrekullen, där bl.a. *Epipactis atrorubens* fångade intresset. På sluttningen ned mot landsvägen ligger skriftställaren EBBE LINDES villaträdgård, innanför vars stängsel åtskilliga av Östergötlands förnämsta botaniska rariteter befinner sig i allsköns välmåga. Här kunde man sålunda stifta bekantskap med *Vicia pisiformis*, *V. dumetorum* och *Pleurospermum austriacum*. Att här föreligger en avsiktlig inplantering — låt vara av numera relativt gammalt datum — har redan tidigare anmälts i den botaniska litteraturen (GENBERG l.c.).

En kvällspromenad ägnades en del av stranden vid Bråviken, närmare bestämt dels ett avsnitt av själva hamnområdet — »Sandviken» —, dels en del av den öster därom belägna Bodaviken. Eftersom den mellanliggande kullen inhägnats som Folkets Park och lördagsdansen redan begynt trådas, tvingades sällskapet göra en kringgående rörelse för att inte riskera bli avkrävt nöjesskatt under botaniserandet. Bland iakttagna arter noterades särskilt: i en vägskärning *Phleum Boehmeri*, *Berteroa incana* och *Camelina microcarpa*; i hamnområdet *Elymus arenarius*, *Chenopodium Bonus-Henricus*, *Descurainia Sophia*, *Calystegia sepium* och *Symphytum officinale* (men ej *S. asperum*, som anges av GENBERG l.c.). På Bodavikens strand antecknades *Herniaria glabra*, *Trifolium fragiferum* (mycket små plantor, ej bestämbara, men av GENBERG från tidigare besök igenkända), *Glaux maritima*, *Armeria maritima*, *Plantago maritima* och *Valerianella Locusta*, ingendera direkt ovanlig men alltid trevlig att träffa på åtminstone för en inlandsbo. Slutligen är att nämna ytterligare några arter högre uppåt land: *Berberis vulgaris*, som borde varit utrotad men alltjämt finnes kvar i ansenlig mängd, *Alliaria officinalis* och *Cirsium acaule*, den sistnämnda på gränsen av sitt utbredningsområde. I den ljumma försommarkvällen var det endast med myggens hjälp man slet sig från de härliga jaktmarkerna för att vila ut före den kommande dagens krävande exkursioner.

Redan i första morgonväkten var en trogen, men ack så liten skara morgonpigga entusiaster redo att följa exkursionsledarna ut på rekognosering i botaniskt outforskade marker mellan Krokeks och Kvarsebo socknar. Under förberedelserna till sommarexkursionen hade förf. bl.a. tagit flyget till hjälp för att rekognosera de kalcitområden, som anges på den geologiska kartan över Kolmården. Just här, i gränsområdet mellan de båda Kolmårdssocknarna, avslöjade en ljusgrön lövträdsfläck i den mörkare barrskogen, att ett sådant kalcitområde nådde i dagen. Ett senare försök att nå platsen visade sig vara relativt svårt: området är glest bebyggt och nivåskillnaderna är ansenliga. Triangelpunkten 90,73 ligger sålunda inte 1000 meter från havsstranden. Omgiven av den här vanliga röda gnejsen ligger kalkstensklippan nära det nästan tvära bergsstupet ned mot Bråviken. Den här avvikande berggrunden i förening med den gynnsamma insolationen har skapat ett synnerligen frodigt och yppigt

Fig. 1. Exkursionsdeltagarna i samlad grupp beundra den vidsträckta utsikten vid Marmorbruket. — Gunnar Harling foto 14 juni 1953.

växtbestånd, som starkt avviker från de omgivande urbergsområdenas. I den tidiga morgontimmen antecknades härifrån en i Krokeks socken under senare år icke noterad art, nämligen *Lithospermum officinale*, dock representerad i Riksmuseets herbarium. I övrigt må nedanstående utdrag ur artlistan vittna om florans sammansättning: *Epipactis Helleborine*, *Corylus Avellana*, *Quercus Robur*, *Silene nutans*, *S. rupestris*, *Anemone Hepatica* i kraftiga bestånd, *Sorbus aucuparia*, *S. intermedia*, *Cotoneaster integerrimus*, *Vicia silvatica*, *Lathyrus niger*, *L. vernus*, *Tilia cordata*, *Daphne Mezereum*, *Moneses uniflora*, *Fraxinus excelsior*, *Viburnum Opulus*, *Lonicera Xylosteum*, *Jasione montana*, *Inula salicina* och *Artemisia campestris*. Ett bad vid 7-tiden på morgonen, sedan undersökningen slutförts, fick bilda den värdiga avslutningen på »de morgonpiggas» exkursion.

Efter frukost färdades hela den samlade styrkan med buss till Marmorbruket, den botaniskt kanske mest kända lokalen i hela Krokek. Här demonstrerade Ingmar Fröman den ena av de båda *Hedera*-lokaler, som han tidigare beskrivit (jfr bl.a. Fröman 1952). Från utsiktsplatsen ovanför branten beundrades den grandiosa utsikten över stora delar av Vikbolandet, och efter vederbörlig fotografering (fig. 1) var det dags att börja de botaniska fältstudierna längs stigen ned mot lägre nivåer av kalcitområdet. Här antecknades förutom tidigare nämnda kalkväxter också *Melica ciliata*, *Scirpus maritimus*, *Listera ovata*, *Melandrium album*, *Thlaspi perfoliatum*, *Melilotus albus*, *M. altissimus*, *Astragalus glycyphyllus*, *Vicia cassubica*, *V. dumetorum*, *Lathyrus silvestris*, *Myrrhis odorata*, *Pulmonaria offi-*

Fig. 2. Exkursionsledarna Erik Genberg och Bertil Wahlin demonstrera *Pleurospermum* vid Oxåker. — Gunnar Harling foto 14 juni 1953.

cinalis ssp. *obscura*, *Eupatorium cannabinum* och *Carlina vulgaris* jämte ssp. *longifolia*. Inte ens lockelsen att få stifta bekantskap med Östergötlands fridlysta *Pleurospermum*-lokal kunde förmå exkurrenterna att avstå från ett smakprov på det friska vatten, som flödade ur en källa vid bergets fot. Småningom återfanns sällskapet emellertid vid Oxåker, vars *Pleurospermum*-bestånd, tidigare skildrat av bl.a. Sylvén (1912) och Horn af Rantzien (1946), nu, sedan bäckravinen igenlagts med rör, flyttat upp till vägslänterna och alltså är synnerligen lättnåeligt. Flera hundratal välutvecklade plantor iakttogs nu (fig. 2).

Stora, glesbebyggda skogs- och mossområden skiljer tätområdena i Krokek och Kvarsebo, och först genom tillkomsten av en landsväg från Sandviken till Kvarsebo för några tiotal år sedan öppnades en förbindelse till denna nordöstliga utpost av Östergötlands län västerifrån. I denna del av Kolmården är den röda gnejsen förhärskande, och glaciala grusbäddar täcker större delen av området. Kalcitområdena, som i Krokek är relativt talrika, om ock till arealen obetydliga, minskar ytterligare i Kvarsebo, och det största kalkberg, som här går i dagen, är beläget vid Säter, ett par km WSW om kyrkan. Det har varit föremål för marmorbrytning, och ett par smärre kalkförekomster strax norr härom har helt nyligen öppnats för bryt-

ning. Till sydbranten vid Säter koncentrerar sig också de intressantaste växtlokalerna i Kvarsebo, vilket icke minst kan utläsas av lokaluppgifterna i KINDBERGS »Östgöta flora» (1901). Åtskilliga av de växter, som ger kalkområdena i Krokek deras karaktär, återfinnes här, och det finns — eller åtminstone har funnits — ytterligare arter, såsom framgår av nedanstående artlista.

[I artförteckningen har med en asterisk (*) betecknats sådana arter, som också av KINDBERG omnämnes för Säter i Kvarsebo.]

Typha angustifolia, *Phalaris arundinacea*, **Elymus arenarius*, *Scirpus silvaticus*, **Allium vineale*, **Polygonatum multiflorum* och *P. odoratum*, *Orchis maculata*, *Listera ovata*, **Neottia Nidus-Avis*, **Epipactis Helleborine*, **Goodyera repens*, *Malaxis paludosa*, *Corylus Avellana*, *Quercus Robur*, *Cerastium arvense*, *Lychnis Flos-cuculi*, **Silene rupestris* (KINDBERG: Kvarsebo), *Melandrium rubrum*, *Trollius europaeus*, *Ranunculus obtusiflorus*, *Berberis vulgaris*, **Dentaria bulbifera*, **Saxifraga tridactylites*, *Chrysosplenium alternifolium*, *Prunus Padus* och *P. spinosa*, **Rosa tomentosa* (KINDBERG: Kvarsebo), *Sorbus aucuparia* och *S. intermedia*, *Cotoneaster integerrimus*, *Trifolium montanum*, *Vicia cassubica* och *V. silvatica*, **Lathyrus niger*, **L. silvestris* och *L. vernus*, **Geranium columbinum*, *Linum catharticum*, *Acer platanoides*, *Hypericum montanum*, *Helianthemum nummularium*, *Viola hirta*, **Daphne Mezereum*, **Sanicula europaea*, *Moneses uniflora*, *Primula farinosa*, *Cynanchum vincetoxicum*, **Lithospermum officinale*, *Pulmonaria officinalis* ssp. *obscura*, *Satureja Acinos* och *S. vulgaris*, *Origanum vulgare*, *Lonicera Xylosteum*, *Valerianella Locusta*, *Valeriana officinalis*, *Succisa pratensis*, *Campanula Trachelium*, *Serratula tinctoria* och *Crepis praemorsa*.

(Förgäves efterletades några av KINDBERG för Säter uppgivna växter, varibland särskilt är att nämna *Hedera Helix*, som dock torde förekomma alltjämt, *Gypsophila muralis*, *Lathraea Squamaria*, *Filago minima*, *Herminium Monorchis*, *Epipactis atrorubens* och *E. palustris*. Åtminstone några av dessa arter torde definitivt ha skattat åt förgängelsen till följd av mänskliga kulturåtgärder. Att *Primula farinosa* alltjämt uppträder vid Säter beror på, att den av en intresserad botanist, stationsföreståndare N. TIBBLING, flyttades till nuvarande växtplats från ett dike, som lades igen för ca 25 år sedan.)

Efter vederbörlig badpaus, vari flertalet exkurrenter deltog, och läskedryckspaus vid Kvarsebo brygga ställdes färden på vindlande vägar mot Nyköping, där Stora Hotellet stod berett att förse de nu tämligen utsvultna resenärerna med allsköns delikatesser. En angenäm samvaro vid middagsbordet blev den glansfulla avslutningen på exkursionens mera officiella del, och sedan de båda östgötska ledarna tagit farväl, styrde bussen åter mot Stockholm, där exkursionen definitivt upplöstes vid 22-tiden på söndagskvällen.

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Bertil J. O. Wahlin.

Föreningens höstexkursion på Djurgården den 12 september 1953.

Den 12 september 1953 samlades ett 30-tal medlemmar av Svenska Botaniska Föreningen och Botaniska Sällskapet i Stockholm vid Bellmansstatyn på södra Djurgården i Stockholm för att i gamla välkända och uppskattade svampmarker tillsammans göra en kort »svamppromenad».

Detta område har namn om sig att under »högsäsongen» höstetid ensamt kunna ge material till en ganska representativ svamputställning, innehållande det mesta av årstidens pedagogiskt värdefulla mat- och giftsvampar. Det är ingenting ovanligt att efter en relativt kort djurgårdsexkursion komma hem med ett par hundra hymenomyceter.

Inte heller denna gång svek Djurgården. Och som ett synnerligen värdefullt komplement mottogs, redan innan parken ännu avslöjat sin ev. artrikedom, innehållet i en på annat håll i stockholmstrakten fylld svampkorg, tillhörig en av exkurrenterna, hr Sven Rundquist; där fanns, förutom blåmusseroner, kremlor, fjällskivlingar o. a., flera ståtliga exemplar av den sällsynta jättemusseronen, *Tricholoma colossus*, avsedd för Riksmuseets samlingar. De vackra fynden uppskattades.

Utfyllnadsområdet bakom Bellmansro ger som alltid denna årstid rikligt med svårbestämda champinjoner, täta bestånd av bläcksvampar, inte minst *Coprinus comatus* och *C. atramentarius*, och även fjällskivlingar, främst *Lepiota naucina*.

Bakom Oak Hill tronade högt uppe i de gamla knäckepilarna några exemplar av den varje år återkommande, guldglänsande *Pholiota aurivella*, som bryter direkt ur sprickor i barken. Den tycks inte ha några svårare patogena verkningar, ty träden se ännu livskraftiga ut, och denna som parasit uppfattade skivling har funnits i dessa pilar åtminstone 30 år.

I Frisens park, dit färden först ställdes, fängslades intresset inte bara av vaxskivlingar, kremlor och spindelskivlingar, av vilka senare åtminstone *Cortinarius triumphans* och *C. anomalus*, båda lika säkert bundna till björken som de längre bort växande sträv- och lärksopparna till sina symbionter, kunde på platsen identifieras. Även en del fanerogama fynd var av intresse. Man frapperades av de synnerligen rika bestånden av hybriden mellan *Veronica longifolia* och *V. spicata*; föräldraarterna söker man dock förgäves här nu. Lokalen är känd sedan 1880-talets början. Vidare väckte ett vidsträckt gräsbestånd ett visst intresse. Det var *Trisetum flavescens* — förmodligen insådd. Slutligen påpekade överste C.-A. Torén en växtplats för *Nasturtium* × *anceps* nära stranden. Exemplaren är mycket svåra att exakt bestämma, varför frågan om vilka föräldrar som här ingår tills vidare får lämnas öppen.

Den största sensationen för dagen väckte en jättesamling jordstjärnor i en av lövmylla fylld svacka i parken. Där växte fyra *Geastrum*-arter. Huvudbeståndet var *G. triplex* (även den kraglösa formen!), men också *G. rufescens*, *G. pectinatum* och *G. Bryantii* var representerade på samma lilla område av ett 30-tal m², där förutom nässlor *Impatiens parviflora* dominerade.

Vid jägmästarebostället söktes förgäves friska exemplar av den färggranna *Boletus luridus*; alla var nedruttnade. Men så mycket vackrare fynd av *Cortinarius orichalceus*, som här har en fast lokal, insamlades under lönnarna i allén.

På en ruderatplats väster om Manilla konstaterades en massförekomst av *Lepiota cristata*; dessutom *Tricholoma grammopodium*, på lövträdsstubbar *Pholiota squarrosa* och en *Helvella elastica* närstående liten höstmurkla bland *Impatiens* och *Atriplex patulum*.

Två intressanta svampdemonstrationer kunde ytterligare göras under denna promenad. Den ena gällde lömsk flugsvamp, *Amanita phalloides*, denna vår utan jämförelse giftigaste svamp, som råkar ha flera pålitliga lokaler under Djurgårdens gamla ekar. Vidare hade vi turen att komma precis till fruktifikationstiden för den svarta kantarellen, *Cantharellus cinereus* (en vecka tidigare hade inte ett enda individ kunnat upptäckas). Det var om denna art Lars Romell, när han för första gången såg de av undertecknad från just denna djurgårdslokal insamlade exemplaren, utbrast: »Möjligen har jag sett dem, men jag har naturligtvis tagit dem för svarta trumpeter.» Och *Craterellus cornucopioides* stod också här under ekar och hasselbuskar i intim blandning med sin säkerligen icke så avlägsna släkting.

Einar Ingelström.

Revisionssammanträde.

Föreningen sammanträdde den 28 april 1953 å Stockholms Högskola under ordförandeskap av professor E. Melin.

De nya medlemmar, som av styrelsen invalts i föreningen, anmäldes.

Ordföranden lämnade ett meddelande om den planerade sommarexkursionen till Kolmården. Skattmästaren gav därefter en översikt av de omplaceringar i mera givande värdepapper som gjorts beträffande huvuddelen av föreningens fonder.

Revisionsberättelsen upplästes av dr W. Rasch, och på revisorernas hemställan beviljades styrelsen och skattmästaren full ansvarsfrihet.

Docent Magnus Fries höll ett med talrika färgfotografier och pressade växter beledsagat föredrag över ämnet: »Bilder ur flora och vegetation i Östafrika.» Med anledning av föredraget yttrade sig professor C. Skottsberg och föredragshållaren.

Sammanträdet bevistades av 43 personer.

Årsmötet 1953.

Föreningen sammanträdde den 19 november 1953 å Stockholms Högskola under ordförandeskap av professor E. Melin.

De nya medlemmar, som av styrelsen invalts i föreningen, anmäldes.

Vid det stadgeenliga valet av funktionärer för år 1954 utsågos: till ordförande professor E. Melin, till vice ordförande professor T. Lagerberg, till sekreterare docent G. Harling, till redaktör för tidskriften intendenten fil. dr S. Ahlner, till skattmästare överste C.-A. Torén, till övriga ledamöter av styrelsen: professor R. Florin, lektorerna A. Frisendahl och I. Holmgren, professorerna C. Malmström, J. A. Nannfeldt, C. Skottsberg och M. G. Stålfelt.

Till medlemmar av redaktionskommittén valdes professorerna G. E. Du Rietz, E. Hultén, T. Lagerberg, C. Malmström, J. A. Nannfeldt och M. G. Stålfelt.

Till revisorer utsågos överste J. O. Örtenblad och banktjänsteman A. Johansson efter dr W. Rasch och revisor E. Wibom, vilka båda undanbett sig återval. Revisorssuppleanter blevo fil. kand. Bo Peterson samt fil. mag. I. Fröman efter lektor A. Liljefors, som undanbett sig återval.

Professor Eric Hultén höll ett med talrika färgbilder beledsagat föredrag med titeln »Genom de fagra riken. Botaniska strövtåg med färgkamera».

Sammanträdet bevistades av 103 personer.

Nya medlemmar.

Vid styrelsesammanträdet den 5 mars 1953 invaldes såsom medlemmar av föreningen: på förslag av assistent B. Peterson: fil. kand. Åke Persson, Lund, fil. stud. Jan Ericson, Malmö, fil. mag. Arne Gustavsson, Lund, fil. lic. Hans Runemark, Lund, och försöksledare fil. dr Ernst Nilsson, Åkarp; på förslag av intendent S. Ahlner: fil. stud. Ulf Högström, Hägersten, laborator Bertil Kullenberg, Uppsala, herr Ingimar Óskarsson, Reykjavik, Island, läroverksadjunkt Arne Skeppstedt, Uppsala, och folkskollärare S. Woldmar, Uddevalla; på förslag av konservator A. Zander: Botanisches Institut und Botanischer Garten der Universität, Tübingen, Tyskland, och Central College, Bangalore, Indien.

Vid styrelsesammanträdet den 28 april 1953 invaldes följande medlemmar: på förslag av intendent S. Ahlner: Dr. Leslie A. Garay, Toronto, Canada, Dr. R. F. Cain, Toronto, Canada, och Dr. Josef Poelt, München, Tyskland; på förslag av assistent B. Peterson: fil. kand. Torsten Ingstad, Lund.

Vid styrelsesammanträdet den 10 oktober 1953 invaldes följande medlemmar: på förslag av docent G. Harling: ryttmästare T. Olrog, Oxelösund, och fröken Violet Ronnheden, Karlskrona.

Vid styrelsesammanträdet den 19 november 1953 invaldes följande medlemmar: på förslag av överste J. O. Örtenblad: med. lic. Inge Smith, Stockholm; på förslag av konservator A. Zander: överstelöjtnant Karl Hasselrot, Mariestad, Libr. Univ. College of the Gold Coast, Achimota, Afrika, och direktör J. H. Walter, Stockholm; på förslag av överste C.-A. Torén: Folkskoleseminariet, Härnösand; på förslag av intendent S. Ahlner: fil. stud. Bengt Larsson, Uppsala, och ingenjör Pekka Airaksinen, Stocksund.

Rudolf Florin

RUDOLF FLORIN

60 ÅR

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MESOZOIC SEED CUTICLES.

BY

TOM M. HARRIS.

(University of Reading, England.)

The position of fossil seed cuticles today seems rather like that of fossil leaf cuticles thirty years ago, only a little worse. Nobody has made a comprehensive study of recent seed cuticles from the palaeobotanical point of view, and so the few studies of fossil seed cuticles have been studies made in a dim light.

Compressions of seeds are probably common in all Mesozoic floras and where leaf cuticles are preserved so are seed cuticles. They have been to a large extent neglected as without present interest and indeed without microscopic study they are of no use at all; but the ordinary methods of maceration raise them into species as well characterised as any leaf, and also into objects of morphological interest. Incomplete understanding of seed cuticles in general hardly matters in characterising a species but somewhat bars the way to understanding the structure of the fossil.

Nathorst was the first to give useful accounts of Mesozoic seed cuticles. In 1908 he described the cuticles of the Conifer *Stachyotaxus* and in 1909(*a*) of the Cycad *Nilssonia* seeds. These accounts were overshadowed by his success in macerating Bennettitalean flowers and did not lead to general progress for many years.

In this essay all I attempt is to indicate what seem to me urgent problems. I shall almost limit myself to Rhaetic and Jurassic seeds because very few other seeds have been studied in this way. Nathorst began a tradition for the Jurassic which is only just spreading to other formations. I feel sure that Palaeozoic seed cuticles would be of greater interest but our knowledge of their cuticles has only begun (Arnold 1948). I cannot attempt a general synthesis but write merely as one of those who have investigated such fossil seeds as they met and then looked at a few living ones for guidance.

Fossil seed cuticles are generally very easy to prepare and are often better preserved than the associated leaves. A difficulty is that the thick coaly substance often breaks into little cubes and one must keep track of their original position. It is important also to carry out the alkaline extraction on a slide under the microscope when uncutinised tissues may be momentarily revealed.

It has been necessary to create some artificial genera for seeds with differently organised cuticles and I am sure still more will be wanted. The commonest in the Mesozoic is '*Allicospermum*' which includes the seeds of *Beania* (*Nilssonia*), and many other fossil Gymnosperms and among modern Gymnosperms the *Cycads* and *Ginkgo*. Conifer seeds are similar or only slightly different.

From this I pass on to the very different seeds of the *Bennettitales* and *Caytoniales* and here we are in greater difficulty for they are not of the Cycad type and one fumbles for an analogy among angiosperms.

Two species of *Beania* seeds have been investigated in detail and three others less fully and all seem almost exactly the same (Harris 1941). The seed is only known in the crushed state but must have originally been ovate with a basal hilum and a pointed apical micropyle. Inspection of the flattened seed shows the large stone around which the crushed flesh forms a rim and the outer cuticle is wrinkled as a result of crushing. Small bulges in the surface of some species are caused by resin masses, like those of the *Nilssonia* leaf but larger. Such resin bodies resist maceration as well as the toughest cuticles.

The thickly cutinised integument shows cells which are cutinised along their whole lateral walls. Stomata occur but are sparse. In seeds generally, stomata are rare or absent, even the great fleshy integument of *Encephalartos* has none at all, and how it respires is not plain!

The micropylar canal is lined by a thin but well preserved cuticle. The two sides have been crushed into contact and the two cuticles have fused inseparably as ordinarily happens when cuticles are preserved in contact. Thus the cuticle is seen as a strip with two sets of cell outlines, the lateral (anticlinal) walls projecting outwards.

Inside the seed, the micropyle expands to become the cuticle lining the inside of the integument and this extends down the upper third of the seed. It then continues upwards again as the cuticle covering the nucellus. These two cuticles, the lining of the integument and the cover of the nucellus, are adherent in the compressed seed

and together form a delicate cap over the upper part of the megaspore.

It is important that this double layer should be understood but it is not easy as almost everywhere it is fragile and being composed of two fused cuticles shows two different sets of cells. It was indeed called a 'structureless membrane' in earlier times.

At the sides these two sets of cells both belong to the integument lining, but when we reach the nucellus the two sets are different for one belongs to the integument and one to the nucellus. Fortunately this double layer does not adhere to the megaspore and can be dissected away.

The nucellar cuticle grows a little darker in colour towards its dome-shaped apex, but at the apex itself the cuticle is missing and here I imagine is the pollen chamber but no pollen has been seen in it in *Beania*. Pollen has however been seen in a corresponding position in the rather similar seed of *Lepidopteris* (Harris 1932*a*).

The tissue between the nucellus and megaspore membrane is represented by a gap of about 0.4 mm at the sides of the crushed seed, but nothing but the slightest layer of coal remains. It is however enough to have separated the nucellar cuticle from the megaspore membrane and prevents their sticking together.

The next and innermost membrane has always been called the megaspore membrane. Thompson (1931) and Doyle (1953) have shown that in recent plants this term is, in part, a misnomer since the female spore and male spore are about the same size when each shows its first nuclear division. We cannot make such an observation in a fossil and although I assume that it would apply to the *Beania* seed I would not assume it for an early Pteridosperm or for *Lepidocarpon*; in fact the idea is not easily applicable to fossil botany. I continue to use the term megaspore membrane for this cuticle in a special sense as the fully grown wall of the megaspore, though its contents has long ceased to be a spore.

The megaspore membrane of *Nilssonia* forms an oval sac and is uniform throughout, being a thick (10 μ) but rather weak membrane. It is usually much creased and the creases may look like cells, but no true cell outlines are visible. It takes stains with great avidity even when only lightly macerated and in surface view appears to consist of a mass of granules about 1—2 μ wide. Where it is folded it can be seen that these granules are really short rods standing on a more continuous membrane. No tissue at all is preserved inside the

megaspore membrane but there is again just enough soluble organic matter inside it to make the two sides of the crushed membrane separate after maceration.

Similar megaspore membranes are widespread in fossil seeds of Cycads, *Ginkgoales,* Conifers, Pteridosperm allies (*Lepidopteris*) and in many unassigned seeds. They are just as widespread in recent Gymnosperms. Though almost without specific characters, the megaspore membrane is of value to the palaeobotanist in showing that his fossil is a seed and not some sort of bulbil or tuber. The only other place where I have seen a similar membrane is in the inside of certain rather massive pollen sacs (*Androstrobus, Williamsonia*). Here it is also granular and non-cellular but much more delicate.

This megaspore membrane seems to me the most mysterious feature of these Gymnosperm seeds; I cannot see why it should occur at all. Though the line of contact of prothallus and nucellus is an important tissue boundary, there is no exposure, and in this it agrees with such objects as *Selaginella* megaspore walls and all microspores which develop cuticles while enclosed and immersed in fluid. I suppose this seed megaspore cuticle is generally regarded as a surviving vestige of the *Selaginella* megaspore wall but I mistrust this view! Such survival would be from a very remote time indeed and plants are deplorably quick to drop really useless parts.

I prefer to regard this cuticle as an organ still performing some useful function and with a survival value which maintains it in existence. I have no idea whether this function is performed in seed development, in dormancy or in germination; I do not even know of any facts about its permeability at different stages. The matter is one for a plant physiologist.

A good number of species of *Allicospermum* have been described and show points of interest. A Rhaetic species, *A. xystum* Harris (1935) associated with *Ginkgo taeniata* is very like the *Beania* seed, but here the flesh is often lost, leaving a naked stone, and the stone is quite often filled with mud and providing an internal cast. Similar isolated stones are commonly associated with *Ginkgo* and *Baiera* leaves in the Yorkshire Jurassic. Some seeds of this general type have been described by Florin (1936). Their special interest is that the inner layers have been seen in section and the megaspore membrane in particular shows its radial rods.

Another Rhaetic seed, that of *Lepidopteris ottonis* (*Peltaspermum rotula*) (see Harris 1932*a*), is of the general *Allicospermum* type but

differs from *Beania* in that the nucellus is cutinised to its base and so presumably is separate from the integument. It is too often impossible to trace the full extent of the nucellar cuticle with certainty for this to afford a practical division of such seeds into two genera.

The conifer *Elatides williamsoni* Harris (1943) has a seed of the *Allicospermum* type, but it is small and the integument is probably a rather thin husk of fibrous tissue. The cuticle lining the integument and the nucellar cuticle can be traced to the base of the seed though they become very delicate.

A striking peculiarity of this seed is the preservation of cellular tissue inside the megaspore membrane, apparently the outer cells of the prothallus, which are preserved as solid brown blocks separated by paler walls. At the apex of the megaspore there are large oval cavities in the prothallial tissue which, in the best specimens irresistibly suggest the eggs of archegonia. I imagine that the oily food reserve of the prothallus has become converted into a resistent resin.

A final seed may be mentioned, that contained in the scale of *Araucarites phillipsi* (see Kendall 1949). Here the external shape of the seed is of course dominated by the cone scale, but the internal cuticles are essentially of the *Allicospermum* type. It may be presumed that the nucellus is free to its base as in *Araucaria* but this cannot at present be proved because the combined nucellar cuticle and integument lining become hopelessly delicate and untraceable.

An interesting feature of this seed is the tendency of the cells of the integument to form little packets which obviously represent a cell which has subdivided to form a group of sister cells. The clearest example of this is in certain recent Araucarian seeds (Cookson & Duigan 1951) but it is seen less strikingly in *A. phillipsi*. Such subdivision of embryonic cells must be normal in an integument and the fact that it is not universally seen I take to mean that the young cells are usually sufficiently plastic at their last division for sister cells to be unrecognisable. Packets then indicate a certain rigidity of cell wall at cell division. It would be worth finding if this corresponds (e.g. in *Araucaria*) to a resting stage in seed growth.

The seeds described by Thomas (1933) as '*Corystospermaceae*' from the S. African Trias resemble the *Lepidopteris* seed in several respects but the internal cuticles are exceedingly delicate and the megaspore membrane was apparently not seen. They can only be included here, if we assume that the specimens macerated as imperfectly developed like most of the *Beania* seeds in the Yorkshire Jurassic.

Caytoniales.

The isolated genus *Caytonia* has seeds which differ profoundly in their cuticles from the *Allicospermum* type and in certain respects are closer to Angiosperms. Three species have been studied and their cuticles are almost identical.

The small orthotropous seeds have a thinly cutinised integument, and this cuticle extends as a lining to the micropyle without any reduction in thickness, but just at the level of the nucellus it virtually ends. It is possible that a vestige of membrane outside the nucellus is the inner lining of the integument. The integument has been studied both by maceration and by thin sections (Thomas 1925) and is remarkably elaborate for its size, approaching the Angiosperms in complexity; I am not however convinced that it is double (Harris 1933). A fortunate peculiarity in two species is a strong tendency for the cells to be filled with a resistent resin giving internal casts armed with spikes which represent the pits. This does not occur in the third species, originally separated as the genus *Gristhorpia*.

The nucellus has a thick and remarkably tough cuticle; it is the strength of this cuticle which holds the isolated seed together and in roughly macerated seeds it is usually all that survives. It shows the conspicuous outlines of rather large, elongated cells, the lateral walls projecting inwards. Towards the micropyle and towards the chalaza the cells become small and isodiametric. The chalaza forms a small, perfectly circular hole in this cuticle. The micropylar end is often a little raised (the plinth of Thomas) and at the very apex the cuticle ceases leaving a hole where the pollen chamber is situated. The only evidence we have of the size of the pollen chamber is given by the pollen grains which occur below the apex. (Pollen grains are also to be found in micropyles but they are commoner though harder to see in the pollen chamber of the nucellus.)

Inside this nucellar cuticle there is usually nothing at all and the two sides are adherent. Favourable specimens however show an obscure trace of a granular matter which may perhaps be a trace of the megaspore membrane.

Thus, disregarding vestigial layers we have in *Caytonia* a rather thin cuticle over the integument and down the micropyle, and a very thick one over the whole nucellus extending without diminution to the tiny chalaza and then no megaspore membrane or virtually none. This distribution contrasts at every point with what we have

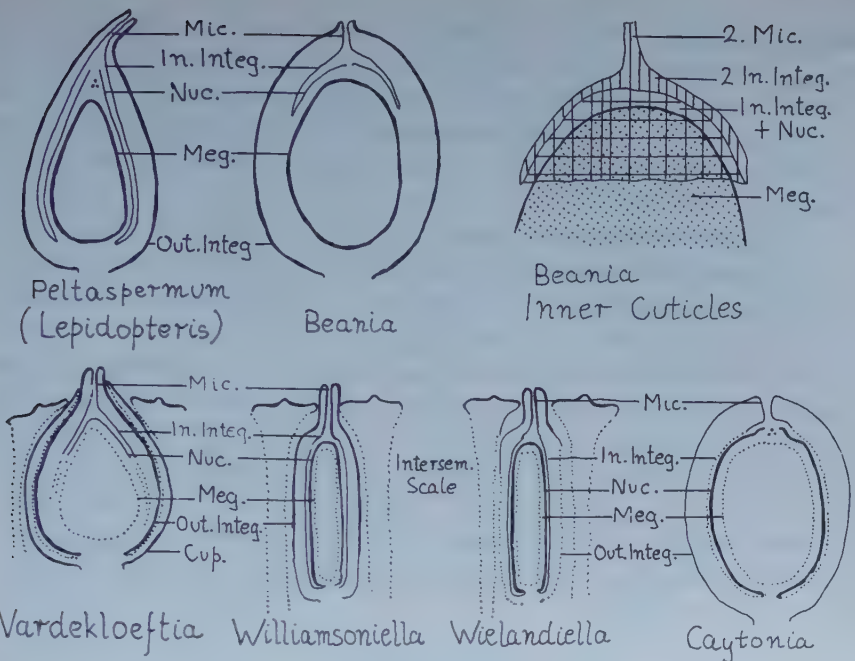

Fig. 1. Diagrams of the cuticles of Mesozoic seeds in LS. Not to scale. Thick cuticles (over 2 μ) shown by thick lines, thin cuticles (under 1 μ) by thin lines, vestigial and non-existent cuticles by dotted lines.

Mic = micropylar canal; In. Integ. = cuticle lining the interior of the integument; Nuc. = cuticle of nucellus, dots at apex represent pollen in pollen chamber; Meg. = megaspore membrane; Out. Integ. = outer cuticle of the integument; Cup. = cupule.

The diagram of the *Beania* inner cuticles represents these as seen in the macerated compressed seed. Micropylar canal and inner cuticle of integument ruled vertically, nucellus ruled horizontally, megaspore membrane dotted. Around the top and sides two thicknesses of micropylar cuticle or inner cuticle of integument are adherent, but in the middle region the inner cuticle of the integument adheres to the nucellar cuticle.

in *Allicospermum*, that is with the usual Gymnosperm type but it agrees at least in part with what is very common in Angiosperms.

I have macerated a number of Angiosperm seeds of various families. The results (see NETOLETZKY 1926 for a fuller account) may be summarised from a palaeobotanical point of view (which neglects layers not observed this way): –

1. The outside of the integument often has no cuticle, but may have a thin one or a fairly thick one. (Anatomical methods are said to reveal one in nearly all seeds, at least at young stages.)

2. In certain seeds an intermediate cuticle (said to be the outer cuticle of the inner integument).

3. In the great majority of seeds examined, an inner cuticle which covers the outside of the nucellus. This is commonly quite thick and I believe corresponds fully to the nucellar cuticle of *Caytonia*. In no seed, as far as I know, is there any cutinised megaspore membrane and the micropyle is seldom cutinised in the mature seed (Netoletzky 1926).

Some physiological experiments have been performed on the seed coats of certain Angiosperms and these indicate that some layer, probably the nucellus is semipermeable. It has even been claimed to be more permeable in the inward than the outward direction (Denny 1917). I will not attempt to summarise these findings, which do not indeed agree fully with one another but they do indicate peculiar properties.

Certain isolated cuticles obtained by the maceration of Cretaceous coals, much resembling isolated *Caytonia* nucellar cuticles, have been recognised (Schemel 1950) as *Spermatites* Miner, a non-committal genus of seed cuticles used also by Arnold (1948) for Palaeozoic seed cuticles.

Bennettitales.

The seeds so far macerated show certain common features: they all have a splendidly developed micropyle and in none is there any well cutinised megaspore. For the rest, their organisation is varied and would be of great interest if it were possible to relate them more securely to one another and to the seeds known in petrifactions. One besetting difficulty in the study of Bennettitalean fruits is that almost every one must be regarded as an abortion, for if anything is certain it is that the large fruit should not remain whole with the numerous little seeds inside. For some kinds we know a series of small stages which I believe are abortions from early stages and not true stages of healthy growth. I have compared them with the little apples which are shed at various times from flowering onwards. These stages do illustrate some features of normal apple development but for the study of the seeds they are deplorable! In but few *Bennettitales* are isolated seeds known; the difficulty is to recognise them.

The most elaborate seed structure (which I here treat as basic) occurs in some species from the Greenland Rhaetic *Vardekloeftia* spp. and in *Bennetticarpus crossospermus* (Harris 1932*b*.) *Vardekloeftia* is known from intact fruits at two stages and from isolated seeds, but *B. crossospermus* only from scattered, presumably ripe fragments.

In both the integument is double. The inner integument is more robust and heavily cutinised and also forms a normal micropyle. It therefore corresponds to the integument of other seeds. In *Vardekloeftia* the outer one forms a rather thin investment through which the micropyle projects. I have called it a cupule. In *B. crossospermus* the outer one forms a flange around the micropyle which looks exactly like the interseminal scale of the same plant except that it has a hole through its middle. The rest of this integument is uncutinised and indeed unknown. We know nothing about the inner cuticles of *B. crossospermus* (which is only known as fully macerated fragments) but *Vardekloeftia* shows a delicate internal cuticle with two sets of cell outlines and presumably represents the fused nucellar cuticle and integument lining. This membrane becomes too delicate to trace to a definite end and so we cannot say how far back the nucellus is free.

I would emphasise the fact that (especially in *Vardekloeftia*) the cutinisation of the (inner) integument is thick in parts completely covered by the cupule.

The remaining *Bennettitales* all show a single integument.

In the Middle Jurassic *Williamsoniella* (Thomas 1915, Harris 1944) many stages of fruit development are known, but not the isolated ripe seeds. The outer cuticle becomes more delicate as it passes back into the sheltered part of the seed but is traceable along its whole length. It shows two sets of cells, but I believe one set is very likely hypodermal.

The micropylar canal, followed back, enlarges to form a cylindrical body which shows the outlines of narrow cells continuing those of the micropyle and broad ones which should be nucellar. At a more mature stage these broad cells become far more obvious than the narrow ones, and the whole membrane is thicker. This double cuticle extends back to the base of the seed and indicates a completely free nucellus, just as in the petrified seed of *Williamsonia* (Sahni 1932).

Very similar cylindrical cutinised bodies occur inside other Bennettitalean seeds. They have been described in two other Greenland species of *Bennettiticarpus* (both possibly *Williamsonias*) and in the much better known *Wielandiella* (Nathorst 1909*b*, see also Harris 1932*b* for seed cuticles). Here again are the conspicuous broad nucellar cells and the faint narrow integumentary ones.

In *Wielandiella* a good many isolated seeds have been found

(recognised by their agreement with the seeds from intact gynaecia). These consist of the cylindrical cutinised body with just a thin layer of brown tissue representing the integument. There is no cuticle round the integument and the micropyle is missing.

It is most unfortunate that the seeds of *Cycadeoidea* have not been studied by maceration. According to WIELAND's account the nucellus is only partly free. WIELAND (1916) recognised an inner layer as the 'megaspore membrane', no doubt rightly but there is no reason to suppose it cutinised.

Summary.

Mesozoic Gymnosperm seeds fall, according to their cuticles, into two main types. In the first, Cycads, Ginkgos, Conifers, the integument is well cutinised, but the protected parts, the nucellus and lining of the integument, are feebly cutinised. The megaspore membrane is, though protected, nearly always heavily cutinised and thus forms the one complete membrane round the endosperm.

In the second (*Caytoniales, Bennettitales*) the main cutinised membrane is most often the nucellus which forms an almost complete membrane round the seed. The cutinisation of the integument is erratic, and not apparently related to exposure (except that in the *Bennettitales* the exposed micropyle is always well cutinised). The substance of the testa may be thin but of complicated structure. The megaspore membrane is not cutinised at all. Many Angiosperms share these characters but I do not take this to mean affinity.

It is tempting to suggest that in these two main types of seed we have two equally workable physiological alternatives, each providing a nearly complete cutinised investment. The suggestion is however idle as there is no evidence that their properties are similar. Nevertheless I do suggest that the difference between these two main types of seed is rather fundamental. Quite a number of things I do not understand seem to me rather fundamental!

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FOSSIL SPOROCARPS OF THE GENUS PROTOSALVINIA DAWSON, WITH SPECIAL REFERENCE TO P. FURCATA (DAWSON) COMB. NOV.

BY

CHESTER A. ARNOLD.

(University of Michigan, Ann Arbor, U. S. A.)

Among the fossils of the Upper Devonian black shales of the east-central United States are detached sporocarps of unknown plants that have been designated *Sporocarpon*, *Foerstia*, and *Protosalvinia*. The particular one with which this account is mainly concerned is a bilobate object a few millimeters long that Dawson (3) described as *Sporocarpon furcatum* in 1888. Subsequently White and Stadnichenko (6), who were apparently unaware of Dawson's work with this particular sporocarp, established the genus *Foerstia* for it, and named it *Foerstia ohioensis* in 1923. Most recent authors have referred to it as *Foerstia furcata*, a binomial accredited to Pia and first published in Hirmer's *Handbuch der Paläobotanik* (p. 109). My observations, however, show that this sporocarp differs in no essential respects from *Protosalvinia* (Dawson, 2), and it is here transferred to that genus.

In a recent treatment of Devonian sporocarps Kräusel (5) established the order *Foerstiales* for *Protosalvinia* and *Foerstia*. The former genus has one species, *Protosalvinia brasiliensis*, and the latter two, *Foerstia ravenna* and *F. furcata*. He distinguishes *Protosalvinia* from *Foerstia* by its unlobed sporocarp and on the presence of conceptacles that contain the spore tetrads. According to him the sporocarps of *Foerstia* are lobed and the tetrads are not in specially delimited cavities. However, I find that if the maceration process necessary to render the tetrads visible is carefully controled, specialized cavities identical with those that Kräusel demonstrates so

clearly in *P. brasiliensis* are present in both species of *Foerstia* (Figs. 9, 13). Since the only distinctive feature of the single species he retains in *Protosalvinia* is an unlobed sporocarp, I see no satisfactory reason for maintaining two genera. Actually the sporocarps of the two species of *Foerstia* are as different from each other as either is from *Protosalvinia brasiliensis*. So the alternative of placing them all in one genus would be to have a separate genus for each. This hardly seems necessary. The genus *Foerstia* is therefore set aside and the three recognizable species of *Protosalvinia* are distinguished as follows:

A. Sporocarps sessile, spore cavities clustered in the upper part
   1. Sporocarps essentially spherical, not lobed or divided *P. brasiliensis*
   2. Sporocarps with apical lobes surrounding the cluster of spore cavities ..... *P. ravenna*

B. Sporocarps stalked, bilobed, spore cavities mostly in one row beneath apical groove ..... *P. furcata*

As stated, Dawson placed *Protosalvinia furcata* in *Sporocarpon*. He took the name from Williamson (7) who had previously coined it for some apparently free living bodies in Carboniferous coal balls. The morphology of these bodies has never been determined, but they are so different from those that Dawson described that it is quite improper to use the same name for both.

The description of "*Foerstia ohioensis*" by White and Stadnichenko was more extensive than any previous one and many new details were recorded. An important one is the presence of spores, which Dawson did not see. However, they were not quite sure as to their identity, and refer to them rather ambiguously as "spores or eggs", and were inclined to regard them as eggs. They assumed that the plant was thalloid and an alga of some kind, and that the conceptacles were oogonia. On the other hand, they correctly interpreted as a spore sac the superficially dissimilar but obviously related *Protosalvinia ravenna*, which they described in the same paper.

Kidston and Lang (4) made an important contribution to our knowledge of *Protosalvinia furcata* when they recognized the resistant character of the walls of the spores, and they stressed the fact that similar spores are not known among algae. They admitted though that the plant might be an alga, but did not place it in any category higher than genus.

The sporocarps of *Protosalvinia furcata* are quite variable in size and shape, although the usual form is that of an enlarged branchlet tip with an apical notch that produces two short lobes of about equal

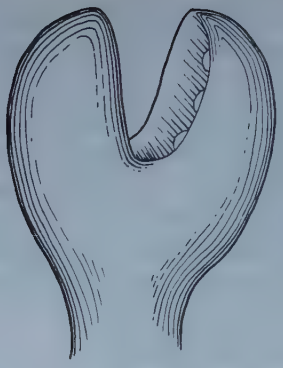


Fig. 1. Semi-diagrammatic restoration of sporocarp of *Protosalvinia furcata*. Greatly enlarged.

size (Figs. 1—4, 7, 8, 10, 12). The pincer-shaped form (Fig. 5) illustrated by DAWSON (3, p. 139) and reproduced in HIRMER's *Handbuch der Paläobotanik* (p. 109) is rare and not typical. Likewise the crozier-shaped specimen figured by WHITE and STADNICHENKO (6, Pl. V, Figs. 5*a* and 5*b*) appears to be a freak, and is rarer even than the pincer type. No specimens resembling it were found during the course of the investigation. Most of the specimens have a simple bifurcation, but an occasional one is double, consisting of two joined basally (Fig. 11).

The sporocarps range from 2—5 mm in width, and the body is about as wide as long. Apparently they were slightly flattened in the living condition with the lesser dimension at right angles to the plane of the lobes. The apical notch is shallow (Figs. 2, 10, 11, 12) or deep (Figs. 1, 4, 7, 8). The shallowly notched forms tend to be triangular in outline whereas those with longer lobes tend to be more oval. The stalk, which is 1—2 mm wide, is not always present. In some specimens nothing remains except a narrow isthmus that connects the lobes (Figs. 7, 8).

The preserved part of the sporocarps resembles the cutinized epidermal layers of higher plants. KIDSTON and LANG refer to the waxy material present in the spore coats and the vegetative tissue as cuticle, but they state that they are not certain about its composition. They use the term "resistant" in describing the spores. KRÄUSEL (5) says that the resistant substance is chitin and silicic acid. A very thin layer of this forms a surface coating over a pseudocellular pattern. At places the pattern resembles an epidermis (Fig. 13) but elsewhere it is more suggestive of twisted ends of hyphal threads that terminate at the surface. KRÄUSEL believes that the sporocarp consisted originally of an interior filled with a hyphal plexus en-

closed by a stroma of which the individual elements were held together by the chitinous matrix.

A prominent feature of *Protosalvinia furcata* that has never received stress by previous writers is the heavy concentration of resistant waxy material at the tips of the lobes and lesser amounts of it in the stalk portion (Fig. 10). During maceration the basal part always clears first. Even after prolonged treatment the tips of the lobes remain dark, and if maceration is continued long enough to render the tips transparent the lower parts will dissolve (Figs. 4, 7, 8). The stalk is very slightly infiltrated and consequently quite unresistant to disintegrative reagents of any kind. It is believed that the heavy infiltration of the tips is correlated with the environment under which the plant grew.

On the two surfaces of the lobes that face each other there is a wide furrow or groove (Figs. 1, 8). Dawson took this to be a dehiscence line, and Kidston and Lang were not sure whether it was natural or the result of compression. My observations show conclusively that it is normal and was present before fossilization. Examples that show no groove are believed to be merely vegetative tips (Fig. 5). The groove extends across the top of the sporocarp from one tip to the other. In small specimens that have short lobes and a wide apical notch the groove forms a craterlike concavity.

Little can be added to the description of the spores. They measure about 216 microns in diameter and have brownish walls about 12 microns thick. No surface configuration of any kind (except the tetrad scar) is visible although adhering particles of extraneous matter sometimes give a deceptive appearance of roughness (Fig. 6).

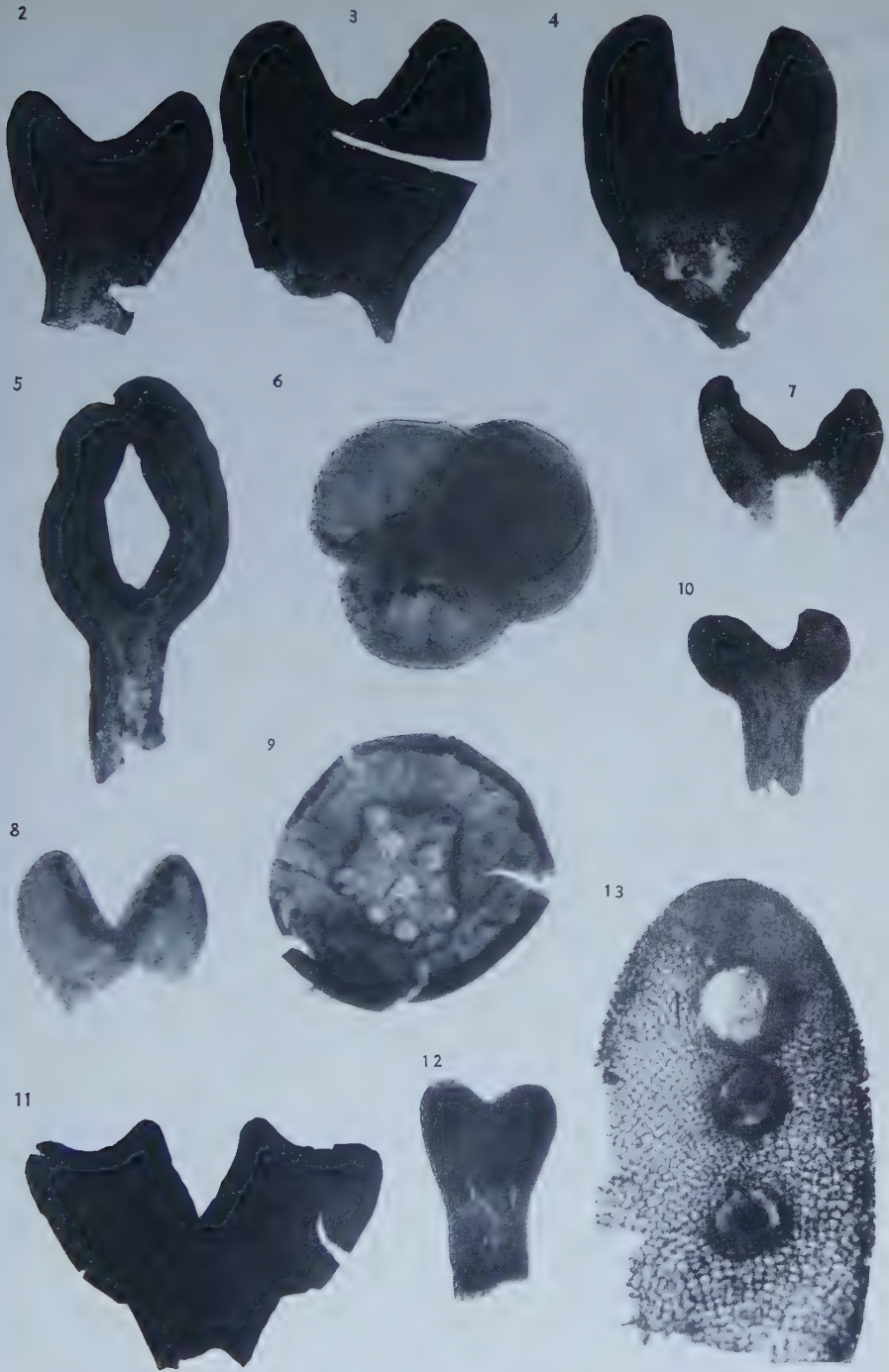
Each tetrad lies within a definitely outlined space, or conceptacle, that was probably originally spherical (Fig. 13). It is about 0.5 mm in diameter and is bounded by a shell-like layer of compacted tissue that is about 90 microns thick. The tetrad does not completely fill the space within which it lies, and has a volume somewhat less than half that of the space. In the flattened condition of the fossil the "shell" around the space appears as a darkened ring (Fig. 13). It disappears with prolonged maceration and is revealed most distinctly when the process is stopped as soon as the stroma becomes transparent. When properly treated it shows plainly. The tendency of the "shell" to become invisible when overly macerated is probably why Kräusel failed to see it and is the reason for his belief that *Protosalvinia* and *Foerstia* can be distinguished by the presence or absence

of specialized cavities that contain the spores. However, my observations show these cavities in both the species of *Foerstia*. Consequently, there is no cause for maintaining this genus as separate from *Protosalvinia*. In other words, *Protosalvinia* becomes *Foerstia* if macerated too long!

The arrangement of the conceptacles in a row extending from the tip of one lobe to the tip of the other shows advantageously in specimens that have been flattened from the vertical direction. KIDSTON and LANG state that the tetrads lie some distance from the margin and in the region of the groove but not directly below it. They apparently saw only specimens that had been flattened laterally and in which the tetrads were probably displaced with respect to their relation to the groove. I have concluded that the tetrads are situated below the groove in most instances, although an occasional one is out of line. A small sporocarp may contain as few as two tetrads and a large one six or eight. Frequently one lies buried at the base of the notch. Just how deeply the conceptacles are submerged within the tissue of the sporocarp is not clear, nor is it evident what kind of covering protected the spores. That they were shielded by a layer of some kind is shown by a structureless substance through which one must look when observing the tetrads in place, but the nature of this layer is unknown.

All investigators of the sporocarps of *Protosalvinia* have assumed that they were produced on a thalloid plant. KIDSTON and LANG were the first to mention the fact that the resistant walls and tetrahedral arrangement of the spores were features foreign to all living algae. Although they concede that the plant might ultimately turn out to be an alga, they remark that it shows a combination of characters that tends to break down a sharp distinction between algae and the simplest pteridophytes. KRÄUSEL concluded from his observations of the structure of the interior and the chitinous exterior of the sporocarps that the *Foerstiales* is intermediate between the algae and the fungi, and proposed for it the class *Algomycetes*.

Although the *Foerstiales* may appear to be intermediate between algae and fungi on one hand, and between thallophytes and the simplest vascular plants on the other, we are still completely ignorant of the appearance of its members when they lived. Moreover, the mere assumption of an intermediate position does little toward solving the problem of relationship to algae or any other group. The question still remains whether they evolved from stock ancestral to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both algae and fungi, whether they are direct algal derivatives, or whether they represent an independent line of development. There is about as much evidence for one as for another. It is likely that the order was derived from thallophytic ancestors of some kind, but that is about as far as speculation can be carried without wandering into the realm of fantasy. Because the group is extinct, it cannot be placed in any taxon of living plants of lesser rank than one which would embody the non-vascular plant plexus as a whole. The occurrence of tetraspores in *Polysiphonia* may be provocative to those who look for relationships in single characters, but detailed comparisons with *Polysiphonia* would accomplish nothing. The similarities White and Stadnichenko saw between *Protosalvinia furcata* and seaweeds of the *Fucus* type are no more than superficial resemblances and the comparisons they made are invalid as indications of relationships.

If *Protosalvinia furcata* is intermediate between algae and the lowest vascular plants, as Kidston and Lang claim, it must, in some respects at least, be on an approximate level with bryophytes. There is no apparent reason for classifying *P. furcata* with the bryophytes but it had evolved parallel to them to some extent and had attained a similar level. Its probable amphibious habit is similar to some of the lower *Bryophyta*, the *Hepaticae*. The sporocarp approximates in a general way that of *Anthoceros*, in which progressive sterilization of tissue in the erect sporophyte has resulted in a structure which is only partly sporogenous. This reduction in the amount of sporogenous tissue is frequently taken as evidence of advancement over lower forms like *Riccia* and has even been brought into consideration of the morphological aspects of primitive vascular plants of the *Rhynia* type. In *P. furcata* even less tissue has become sporogenous than in *Anthoceros* and the fructification has in some ways become an even more highly specialized organ. There is no actual evidence that the whole life cycle of *P. furcata* was any more advanced than that of *Anthoceros*, and it could well have been simpler.

Protosalvinia furcata, *P. ravenna*, and the enigmatic "*Sporangites*" *huronensis* constitute a small assortment of fossil organisms that occur rather abundantly in the Upper Devonian phase of that great black shale formation that bears the names New Albany, Chattanooga, Ohio, Huron, Kettle Point, and Antrim, depending on the locality. The most prolific source of *P. furcata* has been the Ohio shale near Columbus, but it occurs at other places.

The black shales were deposited in an interior sea that during late Devonian and early Mississippian time extended from New York State to Oklahoma and from Canada to Alabama (Campbell, 1). The borders of this sea changed from time to time with the formation of temporary islands and peninsulas. Except on the larger and more durable elevations, the terrain had low relief with expanded mud flats that were inundated frequently although much of the time out of water. There were innumerable shallow pools that completely vanished during intervals of rainless weather, although the deep mud remained saturated not far below the surface.

On these mud flats peculiar amphibious plant forms developed. The process was in no way connected with vascular plant evolution because tracheary elements as a means of more effective water uplift had come into existence long before. In fact, a large vascular flora was already in existence on higher ground when *Protosalvinia* first evolved. The largest vascular plant preserved in the black shales is *Callixylon*, and *C. newberryi*, the best known species, had woody trunks nearly a meter in diameter. Numerous strange ferns and lycopods formed a shrubby covering on the ground. However, there was probably a sharp transition from the better drained soils bearing the vascular flora and the shifting mud flats that provided the environment for plants like *Protosalvinia*.

The appearance of plants of the *Protosalvinia* type on the mud flats represents an attempt on the part of certain thallophytes to cope with adverse conditions. The protective adaptation took the form of waxy infiltration of the surface tissues of the sporebearing organs and the spores. We have no direct evidence of the nature of the vegetative body, but it was delicately constructed, whatever it was, because no traces of it have been recognized among the numerous sporocarps in the shale. It must have been a flat thalloid body that grew close to the ground and which took soil water through rhizoids on the lower side. Vegetative growth was rapid during or immediately following wet weather, but at the beginning of the inevitable and periodic droughts an abundant crop of sporocarps was produced, either directly on the upper surface or on short special outgrowths. The situation may have been analogous to that in many freshwater algae in which the sexual stage of the life cycle and the resultant formation of thick-walled spores immediately precedes drying up of pools in which the plants grow.

The fact that a dozen or more disconnected sporocarps are fre-

quently found together in a mass is evidence that they were borne in close proximity, probably in clusters. The heavy accumulation of waxy material at the tips of the sporocarps indicates an ever present danger of drying out. Without vascular tissues transport of water to the apex where the spores were formed was slow, and during the heat of midday wilting could have occurred despite the presence of nearby saturated soil.

Not being connected with vascular plant evolution, the rise of *Protosalvinia* during Devonian time was a minor episode of nature, one of many attempts to preserve and perpetuate life by meeting adversity through adaptation and adjustment. This attempt was apparently not more than temporarily successful and was inadequate to insure continuity of the particular line. As far as we know *Protosalvinia* gave rise to no other forms and has no descendants.

Summary.

Fossil sporocarps in the Upper Devonian black shales of the east-central United States are known as *Sporocarpon*, *Foerstia*, and *Protosalvinia*. The fossils which WILLIAMSON originally named *Sporocarpon* are different from these, so the name is not suitable for them. *Protosalvinia* and *Foerstia* have been distinguished from each other by the presence in the former of spacial spore cavities that were supposed to be lacking in *Foerstia*. However, these cavities are present in *Foerstia* and are clearly visible in material that has not been macerated too severely. For this reason the genus *Foerstia* cannot be maintained, and its two species, *F. ravenna* and *F. furcata*, are transferred to *Protosalvinia*.

The sporocarps of *Protosalvinia furcata* are bilobate objects that were probably borne in clusters on a dorsi-ventral thalloid plant. The normal form has a pair of blunt terminal lobes, the pincer-shaped form figured by DAWSON not being typical. The tetrads were borne in a row beneath an apical groove that extends from the tip of one lobe to the other. Each conceptacle is bounded by a "shell" of dark colored tissue.

The position of *Protosalvinia furcata* in the plant kingdom is unknown, but it had evolved to a level comparable to that of the lower bryophytes. It grew on wide mud flats that were subjected to seasonal inundations followed by periods of drought. The heavy infiltration of the sporocarps and spores afforded protection from excessive water loss, and was a means of survival.

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Explanation of the Plate.

Figs. 2—8, 10—13. *Protosalvinia furcata* (Dawson) Arnold comb. nov. *Figs. 2—4*, normal form, × 6; *Fig. 5*, pincer-shaped form, × 6; *Fig. 6* tetrad, × 120; *Fig. 7*, small specimen with wide apical notch, × 6; *Fig. 8*, specimen showing apical groove, × 6; *Figs. 10, 12*, small normal sporocarps with stalks, × 6; *Fig. 11*, double sporocarp, each segment with shallow apical notch, × 6; *Fig. 13*, upper surface of lobe of normal specimen showing 3 conceptacles in a row, 1 empty, and 2 containing tetrads, and the surrounding "shell" of dark tissue. The groove has been flattened and does not show. × 25.

Fig. 9. *Protosalvinia ravenna* White and Stadnichenko. Single flattened sporocarp showing cluster of conceptacles beneath upper surface. Each conceptacle is surrounded by a "shell" that shows indistinctly, and surrounding the cluster is a darkened boundary representing crushed lobes. × 6.

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ARE THE PSILOPHYTALES A STARTING OR A RESULTING POINT?

BY

S. LECLERCQ.

(University of Liège, Belgium.)

The supposed phylogenetic relationships of the various groups of the *Pteridophytes* were usually represented as stemming from the *Psilophytes*, which thus are considered as a general starting point. A review of the Siluro-Devonian records shows that another possible assumption exists: that the different races of the *Pteridophytes* had an independent origin issuing from different lines probably running down separately into the algae complex.

The principle of an independent origin of the main races of the vascular plants is certainly not a new conception. It has been expressed and discussed by numerous scientists. Rejected by many, it has been admitted by a few, though positive evidence is still wanting. In that connection, the finding of the Silurian flora of Australia has been the thin end of a wedge driven into the foundation of the general monophyletic dogma. The proof of the existence of representative members of, at least, two distinctive lines, the *Psilophytes* and *Lycopsides*, gave rise to a reaction against the usual "family-tree' conception. The consequence of this reaction has been borne by the *Psilophytales*. This is well shown in recent phylogenetic diagrams. In 1944 (p. 449) Professor Emberger represents the *Psilophytales* as the common root of the Vascular plants. In 1948, Professor Lam regards them as the converging point of the *Pteridophytes* and *Spermaphytes*. Professor Zimmerman, likewise, in 1952 (p. 462), assigns the *Psilophytes* a key-position. In 1952 (p. 83) Professor Lam, already mentioned, gives a new diagram that takes the Siluro-Devonian data into consideration: though open to doubt, the *Lycopsides* join the *Psilophytes* far back towards the Cambrian;

while the *Sphenopsides* and *Pteropsides* are still connected with them; whereas the *Coniferopsides* are related to the *Lycopsides* by means of the *Baragwanatia*. The breaking up of the "family-tree" has begun. In the same way, but in a more reactionary manner, Professor Henry Andrews, in 1947 (p. 252), had already assimilated the new current of ideas which he represented in an interesting schematic diagram of the plant-kingdom. The striking characteristics of his table are that the main races remain distinct throughout, issuing separately from the algae complex, and that the *Psilophytes* have become a secondary issue. What has happened? What are the reasons that have ousted the *Psilophytes* from their keystone position? In fact, it is chiefly a matter of a new interpretation of almost the same data.

The valuable message of the *Psilophytes* seems to have been understood in too narrow a sense. The message is, at least, twofold: *first*, it concerns the limits of the group, its characterization and limitation: its bearing is restricted; *secondly*, a more general meaning concerns the positive evidence of archaic types of vascular plants, strangely simple in their habits and structure, at a very remote epoch, when the crucial phase of transmigration from sea to land was in process of completion. This enlarged signification is constructive. It overrides the limits of the *Psilophytes* themselves and affords a clue to understand the origin of all the phyla. Both meanings of the *Psilophytales* will be considered.

The Psilophytes.

In the present state of our knowledge, the *Psilophytales* concept is a knotty point. There is a general tendency to relate or attribute to this group any form showing simple morphology or structure which blurs its limits. Another factor which adds to our confusion stems from the fact that, for the most part, the data at our disposal are of unequal value, and do not lend themselves to comparison.

Without doubt, our best source of information is derived from the *Rhyniaceae* which have revealed, in full detail, the whole organization of "Urform" land-plants (Kidston and Lang 1919—1921). That is to say: erected leafless axes with terminal sporangium and simple vascular strand made of annulate tracheids.

Closely related to the *Rhyniaceae* is the genus *Psilophyton*. Unfortunately, among the numerous specimens referred to it, most of them are questionable; let us see why. Regarding the spiny axes,

their aspect is variable according to the diversity of form, length and orientation of the spines. Certain shoots have small, rigid, straight, scattered spines. Others have long (8—10 mm) slender, thin (0.3 mm) flexuous, closely set spiny appendages: (*P. arcticum*, Høeg 1942, p. 34, *P. wyomingense*, Dorf 1933, p. 242); the bases of the spines are more or less circular, swollen, conical, "some of them with a central punctiform scar, very much like a nerve in cross section" (*P. arcticum*, Høeg 1942, p. 34); the branching system may be dichotomous or sympodial or pseudomonopodial with subequally dichotomous lateral branches, given off from the main axis, at an acute or wide angle, and repeatedly or infrequently bifurcating at either a sharp or wide angle, flattened in one plane or not. The fructification is a disputed question. Is it represented by the *associated*, terminal sporangia hanging down at ultimate naked branchlets, as reproduced by Dawson (Fig. 1); *or* by the terminal spike-shaped twig with double rows of erected sporangia *borne* on spiny stems (Fig. 2) (Croft and Lang 1942, p. 138)? — In the light of this, is not *Bucheria ovata* (Fig. 4) the loose spike of *Psilophyton wyomingense* as suggested by the author (E. Dorf 1933, pp. 244 and 247)? *Bucheria ovata* shows a very similar construction to cf. *Psilophyton princeps*' fructification. It consists of two rows of small ovate bodies symmetrically disposed on opposite sides and fixed at the distal end of a spineless axis. The spiny stems of *P. wyomingense*, found in association with it, may have been prolonged by spineless outer branches, and the fructification of that type. But, on the other hand, in Germany, Kräusel and Weyland (1938, p. 184), have described *P. pubescens*, which (as stated by the authors) is very close to *P. wyomingense* by the type of spines and the branching system. In any case, the fructification is of a new type. Here the lateral branches, three or four times bifurcated, end in small curved systems that turn inward, and bear small sporangia packed together and projected into the concavity (Fig. 3).

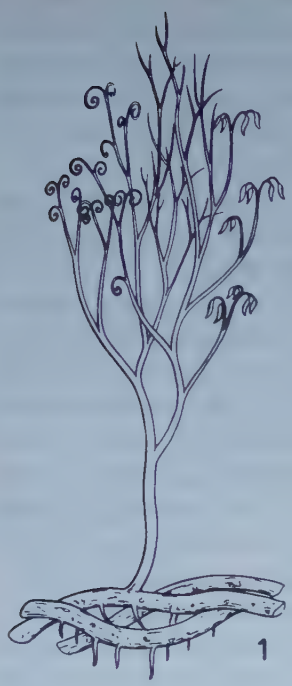
Thus, so far, three types of fructifications, obviously characteristic and different from each other, are related to the same genus. These amazing attributions rest upon the spinous nature of the axis which bears the fructification. This leads one to wonder if the spine-appendages have a systematic value and can be regarded as an evidence of relationship. This opinion is further strengthened by the anatomical structure referred to two species of *Psilophyton*. It is well known that the *Psilophyton princeps* described by Dawson is sup-

posed to present a vascular strand which conforms very closely to the simple bundle of the *Rhyniaceae*. The type of xylem found by KRÄUSEL and WEYLAND in *Psilophyton pubescens* is curious (1938, p. 186). Here, the vascular strand, though not complete, consists of regular radial series of small thick walled cells mixed with "medullary rays" of one to four cells in width. The arrangement of the cells suggests secondary development, as stated by the authors. It appears that, behind the spinous stems, different systematic types are possibly hidden, some of them belonging to *Psilophytales*, others not. Let us recall a few observations: (*a*) The spike-shaped fructification of cf. *Psilophyton princeps* (Fig. 2) (CROFT and LANG 1942) that is closely constructed like *Zosterophyllum*, a spineless *Psilophytales* (Fig. 5);—(*b*) *Psilophyton arcticum* (HØEG 1942) of which "the low cone of the spine basis appears as a diminutive leaf cushion" with, on certain occasions, a "nerve" scar inside (a structure that reminds us of the *Lycopside*);—(*c*) The *Psilophyton pubescens* (KRÄUSEL and WEYLAND 1938) of which the fructification and xylem structure would appear to point to the Ferns, as it will be shown later.

The foregoing facts explain the present perplexity that exists about the characterization of the genus *Psilophyton*. Hitherto, the data at our disposal have increased the complexity of the problem more than they have cleared it up.

The whole class of the *Psilophytales* suffers from troubles similar to that of the genus *Psilophyton*. However, besides the *Rhyniaceae*, there are the *Zosterophyllaceae* which, though in a less spectacular way, have given substantial information. No less than five species have been distinguished, based chiefly upon the fructification variations. The general type consists of a lax-spike with erected sporangia more or less reniform; stalked or sessile, disposed bilaterally or spirally (Figs. 5 and 6). The habit of the plant is probably tufty, with thin leafless axes infrequently dichotomously branched, with,

Figs. 1—6. — Fig. 1. *Psilophyton princeps* DAWSON (After DAWSON, ANDREWS 1947). — Fig. 2. Cf. *Psilophyton princeps*, CROFT and LANG, ×1. Interpreted reconstruction after the holotype (figs. 12 and 12a, Pl. 9, CROFT and LANG 1942). Reviewed by W. H. LANG. — Fig. 3. *Psilophyton pubescens*, KRÄUSEL and WEYLAND, ×2. Clusters of sporangia borne terminally on lateral branchlets repeatedly bifurcated. After KRÄUSEL and WEYLAND 1938. — Fig. 4. *Bucheria ovata* DORF, ×1. Face (*a*), dorsal (*b*) and profile (*c*) view of the dorsiventral spike. After DORF 1933. — Fig. 5. *Zosterophyllum fertile* LECLERCQ, ×2. (*Platy-zosterophyllum.*) Outline drawing of holotype in fig. 2, Pl. 1, LECLERCQ 1942; to show the sporangia in two alternating rows, most are viewed laterally more or less folded, some are bent. — Fig. 6. Reconstruction of an *Eu-zosterophyllum*, ×2. Aerial shoot with spirally arranged sporangia. After WALTON 1940.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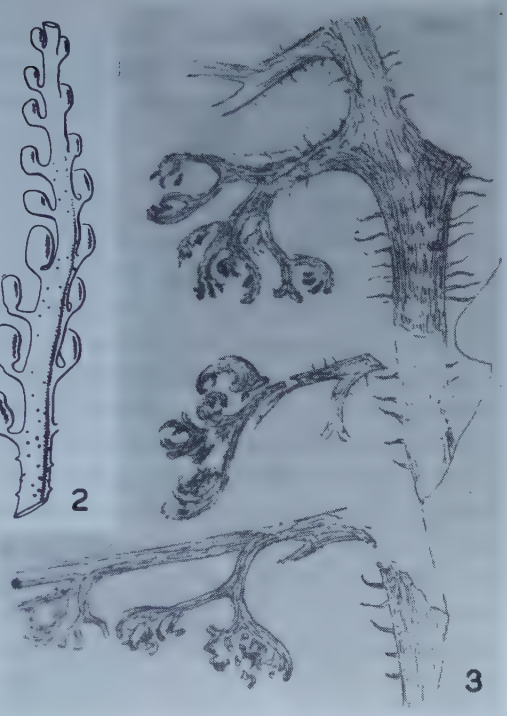
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in some cases, a peculiar H-shaped branching. The vascular strand is of the *Rhyniaceae* type. The geographical area of the genus is amazingly wide. It is known from Scotland, England, Belgium, Rhineland (Germany), to Australia. The stratigraphical distribution is among the oldest. The genus lived in Silurian, side by side with *Psilophyton*'s remains and the proto-Lycopside *Baragwanathia*.

With the *Rhyniaceae*, the *Zosterophyllaceae* appear presently to represent the strongest basis of the *Psilophytales* Class. So far as KIDSTON and LANG's definition (1917, p. 719) of the *Psilophytales* is concerned, the spike-shape fructification of the *Zosterophyllaceae* may be considered as a variation of the fructification theme.

As far as the fructifications are concerned, two main types appear to loom out of the *Psilophytales* fog; they are: (1) *the sporangia borne at the end of the terminal naked branches* including: *Rhynia, Horneophyton, Hicklingia, Cooksonia, Dutoitia, Taeniocrada, Sporogonites, Dawsonites;* and (2) specialized fertile branches consisting of *loose terminal spikes* with rows of erected sporangia including: *Zosterophyllum*, cf. *Psilophyton princeps; Bucheria* (Figs. 2, 4, 5 and 6).

For the present we shall ignore *Gosslingia breconensis* HEARD (CROFT and LANG 1942, p. 141—142) which, in spite of its psilophytic appearance, possesses a dorsiventral and alternate branching, with sporangia borne on the adaxial side or edge of the *lateral* and main axis. In the meantime we shall consider the *Psilophyton pubescens* whose fructification consists of clusters of sporangia, while the vascular bundle indicates problematical secondary growth.

To sum up, so far as we know, the *Psilopsides* certainly include at least two spineless families: the *Rhyniaceae* and the *Zosterophyllaceae*. The *Psilophyton*-like plants represent the real difficulty of the *Psilophytales*. Though they are less misleading than before, since they have given us a hint of the danger hidden behind their external appearance. Despite the fact that, for most of them, our final judgment has to be reserved, they represent a promising source of revelations. But I doubt whether these revelations will strengthen the position of the *Psilophytales* considered as the common root of the Vascular Plant.

Let us now make a brief survey of the Siluro-Devonian records of the other *Pteridophytes*. If the whole *Pteridophytes* class are made of phyla which have been individual from the first, we may admit that the precursors of the *Lycopsides, Sphenopsides, Pteropsides* have known the same difficulties as the *Psilophytes* in gripping the land.

So much so that their habit, fructification and internal structure may have had very much the same aspect. This, however, does not necessarily imply affinity between them, but simply primitive features of more general signification.

The Lycopsides.

Considered from a palaeobotanical point of view, the *Lycopsides* represent a fortunate issue inside the plant-kingdom. The race is followed, without break, from the Silurian up to our own days. So far, the oldest representative is the vigorous *Baragwanathia* which has differentiated leaves, nerves, spirally disposed; a well developed star-shaped xylem; sporangia distributed over the plant, and located, singly, near the base of unmodified leaves, which characterize the plant as a *proto-Lycopsides* (Lang and Cookson 1935). The habit of the plant, its morphology, anatomy and the position of the sporangia indicate a formal separation from the *Psilophytales.*

The discovery of *Baragwanathia* is important, it widens the horizon of our conceptions in many ways: (1) it disjoins the *Lycopsides* from the contemporary *Psilophytes;* (2) within the bounds of the *Lycopsides,* it shows a high differentiated form, preceding in time simpler forms like *Drepanophycus* and *Protolepidodendron*; (3) it raises the question of a possible co-existence of more than two phyla in Silurian rocks and even earlier.

The Lower Devonian genus *Drepanophycus* combines psilophytic appearance with characteristic lepidophytic features. It has spiny leaves and two modes of branching of the axes: dichotomy and H-shaped type (Croft and Land 1942, p. 136; Stockmans 1940, p. 60). These features have been interpreted as evidence of relationship with the *Psilophytales,* until it was demonstrated that these spiny leaves are nerved, and that the fructification is made of sporangia, borne adaxially on unmodified leaves and distributed over the plant.

In this connection, it is not without interest to consider the meaning of some spiny-appendages. Spinous axes are found in varied types of plant. The *Psilophytales* and *Drepanophycus* have already been mentioned. But spines are also found scattered on a *Protoarticulate: Hyenia Vogtii* (Høeg 1942, p. 85), and on a *Protopteridales: Dawsonites Ellenae* (Høeg 1935, p. 3 and 4). The origin, nature and function of spines are no doubt different in many cases. Their glandular nature has been established for *Psilophyton princeps;* the

photosynthetic activity of the nerved spines of *Drepanophycus* is credible. Moreover, we have seen that *Psilophyton arcticum* (Høeg 1942, p. 34) has a nerve-like punctuation in some of the spine-scars, though no strand has, so far, been observed in the spine itself. In consequence of the above facts, I am not inclined, at the present stage of our knowledge, to assign a peculiar phylogenetic value to these appendages, unless their association with other characteristic features of the *Psilophytales* class could be clearly established. The spiny aspect of the *Drepanophycus* leaves is of minor importance compared with the existence of a central strand in the spiny leaves, and the position of the sporangia.

The *Lycopsides*, in Early and Middle Devonian, show an amazingly sudden influx of new forms that leads one to think that the race, at its very beginning, was already composed of a *bundle* of lines. Besides the *Drepanophycus*, the following genera may be mentioned: *Protolepidodendron* (Kräusel and Weyland 1932) with the leaves bifurcating at the tips; *Colpodexylon* with trifurcated leaves (Banks 1944); *Protolepidodendropsis pulchra* (Høeg 1942, p. 132) with well defined leaf-cushions surrounded by flexuous furrows; the robust plant of *Bergeria mimerensis* (Høeg 1942, p. 121) with rhombic sometimes quadratic or fanshaped leaf-like cushions; *Lepidodendron primaevum* (Rogers) in some part being sigillarioid, in others lepidodendroid. These facts are inconsistent with a lineal descent from the *Psilophytes* which are contemporary.

The Sphenopsida.

The earliest unquestionable remains of the *Sphenopsida* are represented by the well-known genera *Calamophyton* and *Hyenia*, both of Middle Devonian. Here, the point of interest lies in the degree of specialization already reached. Compared to the *Lycopsides* of the same age, these plants appear to bear, more obviously, the stamp of the race, as is established by jointed shoots; whorled dissected leaves; triangular-shaped xylem. The fertile appendages are perhaps more significant. In organization and position, they suggest the sporangiophores of the *Calamites* with which they appear homologous.

This is confirmed by the studies of Professor John Walton (1949) on *Protocalamostachys arranensis*. This Lower Carboniferous strobilus has sporangiophores divided at their distal end into four slender pedicels that curve towards the strobilar axis and each bearing a

single sporangium. The sporangia are thus borne on distinct pedicels and not attached to a peltate sporangiophore. In the same way, W. S. Lacey (1943) has demonstrated that in *Calamostachys binneyana*, the sporangiophore head is *cruciate* or divided into *four arms* and not peltate. These facts are consistent with the opinion that the *Sphenopsides* have evolved within a narrow limit of change following a clearly defined pattern. This is confirmed by the modern Articulates, and is certainly not invalidated by the problematical compressions found in the Lower Devonian. In regard to the latter, two small plants have been described. In Germany, Kräusel and Weyland (1930, p. 60) have re-examined the *Climaciophyton trifoliatum*, a small three-angled stem, not more than one mm in diameter, bearing, at short intervals, whorls of three coalescent leaf-like appendages. In the U.S.A., Schulter and Dorf (1938) have discovered in Wyoming, the *Sphondylophyton hyenioides*, a caespitose plant of 3 cm long bearing regularly disposed whorls made of two to four leaf-like appendages, dichotomous at the base and split into truncated linear segments (5—8 mm long; 1—2 mm wide). As stated by the authors, both plants have a thalloid aspect. But regarding the Wyoming species, Schulter and Dorf point out that the plant grew in association with a typically terrestrial flora; the habitat of which appears to have been, occasionally, flooded by fresh water.

As we know, Early Devonian indicates the persistence of shallower seas, land-locked bays, lagoon conditions peculiar to Silurian. This must be kept in mind according to *Climaciophyton* and *Sphondylophyton* that might be interpreted as early ancestors of *Sphenopsides*, in which the algoid appearance would have been retained. Schulter and Dorf (1938, p. 33) emphasize the signification of "these two articulate elements present in Lower Devonian flora which project the history of the *Sphenopsides* much further back than was formerly the case". They consider that the past history of the race "may have been as long as that of the parallel groups of the Early Devonian: the *Psilophytes* and the *Lycopsides*".

On the other hand, specimens of *Hyenia elegans* found in Belgium have the sporangiophores prolonged with linear dissected leaf-like appendages, suggesting that the fertile organ and the leaves are homologous (Leclercq 1940, p. 9). This appears to dismiss the arguable feature according to which the sporangiophore of the *Proto-articulate* would represent the persistence of the original leafless fertile system of the *Psilophytales*.

In the present state of our knowledge, no positive intermediate form between *Psilophytes* and *Sphenopsides* has been found. All we know is, that, from Early and Middle Devonian to our days, the *Sphenopsides*, as a whole, remain perfectly distinct throughout. These facts lead us to suppose that the *Sphenopsides* may have run an independent course from the first.

The Pteropsides.

As in the case of the *Sphenopsides*, we know very little of the Lower Devonian *Pteropsides*; but contrary to the *Sphenopsides*, the multiplicity of their records in Middle Devonian is somewhat baffling.

The most demonstrative remains are offered by the *Protopteridium minutum* from the upper level of the Lower Devonian of Shansi (Halle 1936, p. 16). The small plant has a main axis branched sympodially. The lateral ramifications spread out in one plane. More striking are the cuneate flattened organs borne on the main axis and smaller branches. They are modified in clusters of sporangia, on the ultimate segments. All the gradations between the pinnule-like appendages and the clusters of sporangia are found on the "frond-like" branch. This gives evidence that both organs are homologous. Moreover, a presumably pluriseriate annulus exists on the sporangia. Undoubtedly, these features point towards the Ferns, not to the *Psilophytales*.

A more conjectural fern-like plant is the *Psilophyton Goldschmidtii*. As said by the author (Halle 1916, p. 22), the lateral ramification *spreads out in one plane showing a bilateral symmetry* which recalls the branching of a large dichotomously divided frond. Unfortunately, no fructifications, leaf-like organs, nor internal structures are so far known.

We may also mention the *Psilophyton pubescens* (Kräusel and Weyland 1948), which appears to approach the Ferns in a more marked manner. As it has been indicated page 303, the branching is alternate and apparently in one plane; the xylem appears to have had secondary growth; while the fructification consists of clusters of sporangia borne terminally on lateral branchlets repeatedly bifurcated.

Terminal clusters of sporangia of very much the same aspect occur in two Ferns of Middle Devonian: *Dawsonites Ellenae* Høeg

(1935, p. 2) from Western Norway, and *Aneurophyton Germanicum* (Kräusel and Weyland 1926, p. 118, and 1929, p. 320) from the Rhineland. *Dawsonites Ellenae*, the simpler of the two, has fertile shoots, terminated by clusters of sporangia. The sporangia are reniform and fixed on repeatedly divided stalks. Some of the axis show a few scattered spines. The sterile shoots bear small lateral appendages that end in circinnated recurved tips. This organization presents a general resemblance to the higher differentiated *Aneurophyton germanicum*. Here, specialized fertile fronds exist. They are constructed on the same plane as the sterile frond, but instead of pinnules, small fertile clusters are inserted (Kräusel and Weyland 1929; Stockmans 1948). The minute sporangia are stalked and projected into the concavity. On the other hand, the ultimate pinnules of the vegetative frond are not unlike the recurved tips of the sterile portion of *Dawsonites Ellenae*. It may be that, later, the *Psilophyton pubescens*, *Dawsonites Ellenae*, and *Aneurophyton germanicum* will come to be regarded as related members of the same line of descent.

Another interesting example of Fern-like organization is given by the *Protopteridium Thomsoni* (Lang 1926, p. 185). Though of Middle Devonian, this plant is very simple in habit. The most complete specimen is 42 cm long. From a confused mass of apparently leafless axes arises a long branch, that shows a regularly alternate branching spread in one plane, and is terminated by a fertile region. The latter has a similar alternate branching to that in the lower part. The erected fertile organs are turned towards the axis. They consist of brush-like tufts of linear sporangia, parallely and symmetrically disposed inside the concavity. The anatomy of the axis is fairly complex. It consists of a primary xylem, with two or three irregular lobes, surrounded by a well developed secondary xylem made of scalariform and pitted tracheids and medullary rays (Kräusel and Weyland, 1938). *Protopteridium thomsoni* curiously combines axes of *Hostimella* appearance, with a highly differentiated xylem, and a decidedly fern-like fructification. The associated features found in this species indicate the need of caution in deciding whether impression of simple appearance really represents true primitive plant.

Likewise the *Lycopsides*, the *Ferns* and *Seed-Ferns* of the Middle Devonian have evolved extensively.

We are well informed on several species of *Protopteridium* (four) and *Aneurophyton* (three). Contemporaneous with them are: *Sval-*

bardia polymorpha (Høeg 1942), a relative form of *Archaeopteris* genus of Upper Devonian; *Barinophyton* (Kräusel and Weyland 1938, Arnold 1939, Stockmans 1948, Høeg 1942), a separate fertile shoot of large-size Fern; *Cladoxylon scoparium* (Kräusel and Weyland 1926), a rather large polystelic Fern.

On the other hand, petrified material is not infrequently found. It has brought to light varied types of simple or elaborate organisation: the simple *Iridopteridaceae* (Arnold 1940) with a triangular or lobed xylem that point to the Paleozoic *Zygopteridaceae* (*Iridopteris, Reimannia, Arachnoxylon*); the *Cladoxylon* and *Asteropteris* with elongated simple or divided curved xylem strands; the *Actinopodium, Schizopodium*, more strongly related to the *Pteridosperms.*

If the *Ferns* and *Seed-Ferns* have the same line of descent, they presumably evolved very early in distinct directions.

The plant association of the Middle Devonian reveals an average level of differentiation much too high to have issued from the almost contemporaneous *Psilophytales.*

While the Ordovician, Silurian and Lower Devonian represent periods on innumerable attempts and failures—with a few winners! —the Middle Devonian is characterized by increasing changes within the polarized races. In Middle Devonian, "les jeux sont faits", "the die is cast".

If we try to visualize the past history of the *Pteridophytes* and come to any conclusion, it appears that the *Psilophytales* represent a division possibly equal in importance to that of the *Lycopsides, Sphenopsides, Pteropsides*, running parallel with them, instead of being their converging point. The chronology of the record and the stratigraphy seem to emphasize that view. If this conception were confirmed, the *Psilophytales* might be considered as a resulting point instead of a starting point. I mean, a group whose identity proper is not yet cleared up but has its own potentiality. A group which represents an ending side-line of evolution, though it may have had a flourishing time in the Early Paleozoic and a cosmopolitan geographical extension. In that way, the numerous impressions of the Lower Devonian which have not yet revealed any or very little of their internal structure or fructification represent a hopeful field for the understanding of the *Psilophytales* complex.

Other fields of research exist. For instance, the Silurian flora, which so far have only been touched upon. Regarding this the Senni

beds of the late Lower Old Red Sandstone are particularly promising. Another source of information by which our knowledge of the earliest vascular plants may increase, is represented by the spores abundantly spread in the Siluro-Devonian rocks. The range in size and variety of type suffices to foreshadow the rich and distinct flora which flourished in those times. Despite the fact that isolated spores or spore-masses are referred with difficulty to the mother-plant, their very presence is of major interest in a rock reputed as unfossiliferous. In this way, Professor THOMSON (1952) has pointed out the sharp difference existing in the spore flora of the Lower and Middle Devonian rocks. This is in conformity with the distinctive flora of these two geological horizons. Simple types of spores have been collected from a Coblencian bed of Münsterfeld and Daun (Germany). The spores are smooth, thin-walled, circular or elliptical, with or without triradiate markings. On the contrary, a Middle Devonian seam in Esthonia has revealed spores with a dotted appearance; short, long or hooked projections and wing differently developed.

Despite the prevailing scepticism regarding the existence of precursors of the vascular plant in Cambrian, I am inclined to admit that possibility.

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THE PLANT ON WHICH THE GENUS PACHYPTERIS WAS FOUNDED.

BY

H. HAMSHAW THOMAS.

Adolphe Brongniart founded the genus *Pachypteris* in 1828 (Prodrome, p. 49) for fern-like fronds with the following characters: "Pinnules entières, coriaces, sans nervures ou traversées par une nervure simple, rétrécies à la base et non adhérentes au rachis." To this genus he assigned specimens which he regarded as belonging to two species which he named *lanceolata* and *ovata*, both from the Lower Oolite of Whitby on the coast of Yorkshire. He believed that these fronds were distinguishable by their remarkable thickness, their shining appearance, the form of the pinnules, and by the absence of distinct veins. Subsequently in the Histoire (1828*b*, pp. 166—168) he gave a fuller description of his genus and of the two species, accompanied by figures.

In 1829 John Phillips published his "Illustrations of the Geology of Yorkshire", in which many fossils were figured with their names but without any descriptions. Among these are parts of two fern-like fronds, one an incomplete pinnate structure, the other part of a bipinnate leaf. Both are remarkably similar in outline to Brongniart's figures, and they may have been made from the same specimens. There is, however, an important difference, for Phillips showed his pinnules as having no distinct midrib but a series of longitudinal, slightly spreading veins. His figures were named *Sphaenopteris lanceolata* and *Neuropteris laevigata*. The confusion thus begun was increased by Zigno (1856, p. 118) who recognised Brongniart's genus and species, but made the specimens figured by Phillips the types of two species of his new genus *Dichopteris*. He gave figures (Pl. XIV, figs. 2, 3) copied from the "Geology of

Yorkshire", but redrawn to accentuate the supposed veins. In his description he reported that the specimens were found at Saltwick, at Egton Moors and at Hayburn Wyke, near Whitby, but his authority for this statement is unknown. In the third edition of his work PHILLIPS (1875, p. 200) adopted ZIGNO's names for his original figures, and gave them brief descriptions. He mentioned that the figured specimens had been examined by BRONGNIART and himself in 1825, but that they could not be found in the museum at York at a later date. He also pointed out that the plants figured by BRONGNIART and himself were generally supposed to be identical, although the published figures were essentially different.

Pachypteris was thus the first genus to be described of the Mesozoic fern-like fronds with thick cuticles, now regarded as belonging to the pteridosperms. Subsequently several authors found elsewhere fronds of a somewhat similar character for which other genera were created, although their relationship to the original genus was obscure because its exact characters remained uncertain. This affected the status of the species of *Thinnfeldia*, *Dichopteris*, and *Scleropteris*, and the uncertainty attracted the attention of palaeobotanists. SAPORTA (1873, p. 364) proposed that the name *Pachypteris* should be abandoned. NATHORST (1880, p. 60) considered it synonymous with *Thinnfeldia*. SEWARD (1900, p. 169) reviewed the position, united the two species under the name *P. lanceolata*, and figured two other specimens, neither showing any veins. An excellent review of the problems involved was given by HALLE (1913, p. 39); he had collected a new specimen in Yorkshire which seemed to confirm the statements of NATHORST and SEWARD. In some of the pinnules there seemed to be a number of sub-parallel lateral veins radiating slightly from the line in which the midrib would be expected. He thought, however, that *Pachypteris* and *Thinnfeldia* should be retained as separate genera. ANTEVS (1914, p. 10) in his account of the genus *Thinnfeldia* discussed *Pachypteris* and concluded that important differences existed between these genera. He figured a new specimen from Yorkshire, and added another species to *Pachypteris* by the transfer of SAPORTA's *Thinnfeldia incisa*. DUTOIT (1927, p. 341) gave his views on the genus, and referred to it some specimens from the Triassic of S. Africa. More recently the whole question has been dealt with by FRENGUELLI (1943, p. 239) in a survey of present knowledge.

But *Pachypteris* has remained an obscure genus because of the

loss of the type specimens, and the lack of a good collection of forms, from the same area and horizon, which were closely similar to those which BRONGNIART described. Such a collection should clear up the question of the venation, and show if the fronds were bipinnate; it might show if the examples described as two species were connected by intermediate forms, and provide information which was not available to BRONGNIART. Some years ago I was fortunate in finding a number of new specimens, which agree very closely with the original descriptions, at a locality about 25 miles W. of Whitby.

The object of the present communication is to describe these new specimens and to consider what modifications are needed in the original descriptions given by BRONGNIART. Suggestions will be made as to the status of the two forms thought by the original authors to represent distinct species. It will be seen that *Pachypteris* must stand as a very distinct genus, separable from *Thinnfeldia* by the form of its fronds as well as by its cuticle structure.

Pachypteris is a very rare plant. During the forty years in which I have collected in Yorkshire, I have only found specimens on two occasions. Although my collection is not as complete as I should wish, it seems worthy of description at the present time. The plant had bipinnate fronds, and the material now available consists of 23 specimens which show part of the rachis with attached pinnae, together with about a dozen smaller specimens showing parts of pinnae but in which the rachis is not present. With the exception of one specimen, all the material was found by the writer at Roseberry Topping, 3 miles S.W. of Guisborough in North Yorkshire. Here beds of dark micaceous shales containing many well preserved plant remains lie in a channel or basin cut in the underlying Liassic sediments (THOMAS 1913). The flora of these shales is a rich one; it contains several forms characteristic of the lower part of the Lower Deltaic (Estuarine) Series in the Lower Oolitic rocks. The soft fine grained matrix was very favourable for the preservation of the plants in it; the leaves with thick cuticles can be readily detached from the rock, adhering particles of the matrix can be washed off, and both sides can then be examined under a microscope. Well preserved cuticle preparations can be obtained, but it is not proposed to describe these in detail in the present paper. The matrix has one serious disadvantage in that it was impossible to obtain large and complete specimens of fronds because the rock breaks up so readily. My largest specimen shows part of a frond 11 cm long, but most of

the pieces are from 3 to 7 cm in length. It may well be that several of them represent parts of one original frond, but it seems certain that several different fronds, perhaps from different branches of the parent plants, were represented. This is important when we come to consider whether there were two or more species of *Pachypteris* in the area.

My specimens show a wide range of size and form. Had they not all been found close together, they might well have been thought to represent the remains of two or three species. A few examples show some large pinnae, comparable in form and size with the specimens described or figured by PHILLIPS and by BRONGNIART under the specific name of *lanceolata*. These prove that the early figures depicted incomplete pinnae detached from a rachis, and not parts of a simple pinnate frond. I have also parts of fronds with short pinnae bearing closely set pinnules, obovate or spathulate in form, and even smaller than those figured by PHILLIPS as *Neuropteris laevigata*. The majority of my specimens are intermediate in size and form between these two extremes, and provide a fairly complete series of stages between the larger and the smaller types. The structure of the cuticles of all the types is essentially similar, so that I believe that we are justified in regarding all of them as belonging to one species, though the examples with small pinnules must have come from fronds of a different form from that shown by the larger specimens.

Assuming that all of the larger material came from fronds of the same species, these may be described as follows. Fronds bipinnate and much divided 4 to 7 cm broad and probably up to 20 cm or more in length; probably broadest near the apex. Rachis 2—4 mm wide, tapering gradually towards the apex, generally showing a few longitudinal ridges. A close series of sub-opposite pinnae are borne on either side of the rachis, and between the successive pinnae pinnules having long decurrent bases, which form an almost continuous wing on either side of the central axis. The pinnae are linear or linear lanceolate in general outline, apart from those immediately below the apex of the frond; they lie at an angle of 30—40 degrees to the rachis, are parallel to each other and generally overlap a little. The pinnae vary considerably in size, and in the shape and size of their pinnules. In some examples, as shown in Fig. 1, the frond was asymmetrical, two of the lateral pinnae on one side near the apex being much longer than those opposite to them, and more strongly developed than those immediately above and below them. One of

Fig. 1.

Fig. 2.

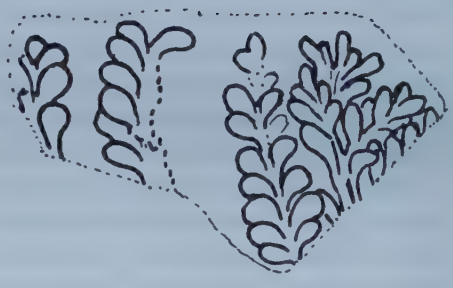

Fig. 3.

Fig. 1. *Pachypteris lanceolata* Brongn. from Roseberry Topping. Upper side; the representation of vein-like parallel ridges, seen mainly in the mould of the under side, is somewhat diagrammatic. Nat. size.

Fig. 2. *Pachypteris lanceolata* Brongn. Example of the commonest form of frond. Nat. size.

Fig. 3. Example of the type of frond named by Brongniart *Pachypteris ovata*. An incomplete fragment. Enlarged $^4/_3$.

these is more than 5 cm long, and shows a series of pinnules on either side which are lanceolate in shape, about 10 mm long and 3 mm wide at the broadest part. Near the apex of the frond the pinnae are shorter, less dissected and sometimes entire; they vary considerably in outline, but generally show a flabellate apical pinnule with lateral lobes. Similar apical pinnules are found at the tips of all the complete pinnae that have been studied, but they are usually shorter

and less lobed than those near the frond apex. The larger apical segments and the broader pinnules often show four or five longitudinal ridges, especially on their undersides, which appear to spread outwards from their base. These ridges at first sight seem like veins, and may possibly indicate the courses of veins embedded in the mesophyll. But on examination under a microscope they do not show any of the usual elongated cells in the epidermis, stomata are distributed evenly over them, as in the other parts of the lower epidermis, and they are invisible in the cuticle preparations. They cannot, therefore, be regarded as being the actual veins of the lamina.

The majority of my specimens (as shown in Fig. 2) are smaller than that shown in Fig. 1. They have pinnae 3—4 cm in length bearing a series of uniform lanceolate pinnules 5—8 mm long and 2—3 mm broad. The pinnules have an obtuse apex and taper somewhat towards the decurrent base; they often show one or two slight crenulations near their apex. Their upper surface is smooth, but on the underside a distinct midrib of elongated cells can be seen under the microscope. This midrib appears to divide up and disappear in the upper part of the pinnule. Other specimens (Fig. 3) have shorter pinnae bearing elliptical or obovate pinnules whose margins overlap, and which may be united at the base. These appear to be of the type which Brongniart figured and described as a separate species. The best example shows part of a rachis 6 cm long bearing 14 sub-opposite pinnae, 9 mm long at the base of the specimen and 15 mm at the top. The broadly ovate or semicircular segments of the lamina are 2—3.5 mm long and are fused at their base; the terminal pinnule is deltoid, with one or two marginal notches. Some fragments of fronds show pinnules which are intermediate in size and form between these small examples and the commoner type.

All the different examples show pinnules on the rachis between the pinnae, as in several other genera believed to belong to the pteridosperms. These "Zwischenfieder" vary considerably in size in the different specimens (4—17 mm), they are generally somewhat shorter than the adjacent pinnules, are bluntly rounded at the apex, and are flattened in the plane of the frond. One of them occurs immediately below each pinna, which might be said to arise in its axil.

A specimen of what may be the remains of a young frond was found at Hasty Bank, about 6 miles South of Roseberry Topping in a bed of the same age. This example is incomplete and is 5 cm long

by 12 mm broad; its rachis is 2 mm broad at the base tapering to 1 mm above; the pinnae are 5—9 mm long and their lamina is less fully dissected but pairs of small lanceolate pinnules are seen at the base of most of them. This specimen has the cuticular structure which is characteristic of the other examples, apart from the fact that a few stomata occur on the upper epidermis near the tip of the terminal pinnules.

A full description of the cuticular preparations obtained from my material will be given later, but it may now be mentioned that the epidermal structure of *Pachypteris* is quite distinct from that of all other forms which have been studied. The smooth upper epidermis was composed of very thick walled cells of a uniform character, irregularly rectangular or polygonal in shape, rather broader than long and tending to be arranged in longitudinal rows. Stomata are very rarely seen on this surface. The lower epidermis shows a marginal band, up to half a millimeter wide, of thick cells like those of the upper epidermis, from which stomata are absent. The midrib of the pinnules is represented by rows of elongated cells without stomata, extending from the base to a point about 2 mm or more from the apex. Stomata occur in large numbers between the midrib cells and the marginal band; they were of the general form common in the mesozoic pteridosperms with sunken guard cells and a ring of thickened subsidiary cells. The distribution and orientation of the stomata was irregular. Epidermal cells between the stomata are irregularly polygonal, often isodiametric, and thick walled.

The discovery and study of the specimens described above shows that they belong to a distinct and easily recognisable group. The descriptions given by Brongniart of his genus *Pachypteris* and of its two species, apply very closely to my material, although his figures show specimens which are somewhat different from any of mine. His figure of *P. lanceolata* is a little larger than any of the pinnae in my specimens, and the enlarged detail seems somewhat diagrammatic, though it shows the outline of a pinnule which is of a common type. The form which he depicted under the name of *P. ovata* is perhaps less accurately represented. Neither Brongniart or Phillips recognised the characteristic pinnules borne on the main rachis between the pinnae, but the former noticed and represented the terminal pinnules of the pinnae. The spreading venation shown in the figure of *Sphenopteris lanceolata* by Phillips most probably represents the longitudinal ridges on the larger pinnules mentioned

above, but the vein-like striations in his figure of the smaller species are without justification.

The variable form of my material shows that there is no reason to doubt that the specimen drawn by WILLIAMSON for SAPORTA, and refigured by SEWARD, belongs to the same species. This wide range of size and form also justifies the belief held by SEWARD, HALLE and others that no distinction could be drawn between the *lanceolata* and the *ovata* forms. But although we can now be certain that large and small fronds of the *Pachypteris* type existed together, and that they had similar cuticles, their derivation from plants of a single species cannot be regarded as finally proved.

There can now be no question about our recognition of BRONGNIART's genus as a distinct and well defined plant, his surmise that the fronds were bipinnate and that they had pinnules with a midrib was correct. It follows, therefore, that ETTINGSHAUSEN's genus *Thinnfeldia* was a new and distinct form, as is shown both by the shape of the fronds and by the cuticle structure.

The new specimens add to our knowledge of the form of the fronds and seem to indicate that the occurrence of "Zwischenfiedern" and of deltoid terminal pinnules are constant characters of diagnostic importance. It will probably be difficult to determine whether all the species that have been referred to *Pachypteris* have been correctly classified, but it is likely that cuticle characters will provide the surest guide.

Botany School, University of Cambridge, March 1954.

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SOME INTERESTING PLANTS IN THE ZECHSTEIN OF THE BORING OOSTZAAN I (THE NETHERLANDS).

BY

W. J. JONGMANS.

(Geologisch Bureau voor het Nederlandsche Mijngebied, Heerlen, Nederland.)

With some remarks on the fauna in the same horizon by S. van der Heide.

The material from this boring was placed at our disposal by the N.A.M. (Nederlandse Aardolie Maatschappij). We are much obliged for the permission to publish it.

Over the Carboniferous in this boring a mighty sandstone was found, over this a series of unknown age and still higher Zechstein was present. By a detailed research in the series of unknown age some shells, which will be described by Dr. van der Heide in the second part of this paper, and plant remains were discovered.

The most remarkable material is figured here (Figs. 1, 2, which are counterparts). Our first opinion was that we were dealing with a Conifer. I had the good opportunity to show it to Prof. Florin, Stockholm, when he paid a visit to Heerlen. His opinion was that the plant belongs to the Algae and more especially to the genus *Piaea* which was described by him as a new genus of *Siphonocladales*.

Florin described three species: *P. ilekensis* (Geinitz), *P. punctata*, and *P. gigantea*.

One of these, *P. ilekensis*, was described originally by Geinitz as *Piceites ilekensis* Gein. This agrees with our first impression that the specimen could belong to a Conifer.

The general structure of the genus is rather simple. Florin described this as follows:

"Thallus ausser in der Sprossspitze und an den Kurztrieben schwach verkalkt, aus mehrzelligen, wenig verzweigten, wirtelige Kurztriebe tragenden Sprossen aufgebaut, in einer plankonvexen Zelle endigend. Sprossachse verhältnismässig dick. Kurztriebquirle alternierend, dicht gestellt."

One single specimen was found showing the thick axis and the lateral organs. The preservation of the material makes a close comparison with the described species rather difficult. Judging from the dimensions of the lateral organs, it seems to correspond more closely to *P. gigantea* Florin than to any of the other species. *P. gigantea* corresponds in many respects with the other German species: *P. punctata* Florin. Its dimensions, however, are much greater than those of *P. punctata*, and the lateral organs are less erect. The two German species occur together at the locality Büdingen in Oberhessen. According to Florin they can be distinguished rather easily.

P. punctata was found at: Büdingen and Bleichenbach in Oberhessen. These localities belong to the Upper Zechstein.

The third form described by Florin is *P. ilekensis*, which formerly was named *Piceites ilekensis* by Geinitz (1880, p. 31, Pl. 4, f. 19, 19a). This species resembles much *P. gigantea*. The number of the lateral organs seems to be greater and these organs are somewhat smaller.

P. ilekensis was found in Iletzkaja Saschtschita, near Orenburg, Zechstein.

As the known specimens exclusively belong to the Zechstein, it can be concluded that the rocks, in which our Dutch specimen was found, also belong to the Zechstein.

The Dutch locality is the fourth one known for this genus.

In somewhat higher horizons we collected specimens of *Ullmannia* cf. *bronni* (Fig. 3). Dr. Dijkstra was able to examine some small fragments of coal, attached to the leaves. These fragments show an epidermis which agrees with that observed in *U. bronni*. This species was found several times in the Zechstein of the Peel-region, in the borings 5[a] Helenaveen, 11 America, 18 Maris.

Together with these leaves some other coniferous needles are found in the Peel-borings. They are well preserved and it will certainly be possible to obtain microscopical preparations. At present, my time does not permit of these researches.

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1
2
1a
2a
3a
4
7
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5

PALAEOZOOLOGY.

By Dr. S. VAN DER HEIDE.

In this boring somewhat higher than the horizon, in which *Piaea* was found, some fossils could be collected.

Bakevellia antiqua
Bakevellia cf. *antiqua* (Fig. 4)
Bakevellia cf. *sedgwickiana*
Bakevellia sp.
Edmondia cf. *murchisoniana* (Fig. 5)
Edmondia sp.
Monotis speluncaria (Fig. 6)
Lingula credneri (Fig. 7)
Lingula sp. (fragments)
Bryozoa
Ostracode.

The composition of this fauna indicates a Permian age. It is difficult to decide to which subdivision it belongs. A comparison with Britain (W. EDWARDS, The concealed coalfield of Yorkshire and Nottinghamshire, Mem. Geol. Survey, 1951) shows that some of the fossils (*Bakevellia antiqua* and *Lingula credneri*) occur in the Upper Permian Marl of Nottinghamshire. The sediments in which the Dutch fossils are found resemble that Marl lithologically. However, the same species are known in the slightly younger Lower Magnesian Limestone. According to SHERLOCK (The Permo-Triassic Formation, London, 1947) the Marl Slates, which are between the Basal Breccia and the Lower Magnesian Limestone, belong to the Upper Permian.

The fauna in the Oostzaan boring is poor and the specimens are small. The stratigraphical determination is therefore rather difficult.

Explanation of the Plate.

Figs. 1, 1a; 2, 2a. *Piaea* cf. *gigantea* FLORIN. — The two figures show the counterparts of the specimen, both enlarged (three times).
Fig. 3, 3a. *Ullmannia* cf. *bronni*. — Fig. 3a enlarged three times.
Fig. 4. *Bakevellia* cf. *antiqua*. 3/1.
Fig. 5. *Edmonia* cf. *murchisoniana*. 3/1.
Fig. 6. *Monotis speluncaria*. 3/1.
Fig. 7. *Lingula credneri*. 3/1.

All the specimens were found in the Zechstein of the boring Oostzaan I.

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GIBT ES ANGIOSPERMIDE EIGENSCHAFTEN AN PALÄOZOISCHEN SPOREN?

VON

ROBERT POTONIÉ.

(Amt für Bodenforschung, Krefeld, Deutschland.)

Mit Ergänzungen von G. Erdtman (Palynologisches Laboratorium, Stockholm).

Um festzustellen, welches die besonderen Eigenschaften des Angiospermenpollen seien, ist von den rezenten Angiospermen auszugehen. Nur hier kann definiert werden, was als angiospermisch zu gelten habe. Wegen der Vergleichsmöglichkeiten mit dem fossilen Material fesselt zunächst am meisten der weitverbreitete Typ des tricolpaten und auch tricolporaten Pollen.

Grundlegend für alle weiteren vergleichend morphologischen Überlegungen ist dabei die Position der Merkmale in der Pollenmutterzelle bzw. in der Pollentetrade. Beginnt man nicht bei diesem Sachverhalt, so kann man zu völlig falschen Schlüssen gelangen.[1]

Wir gehen von einem anschaulichen und leicht zu beschaffenden Material aus, der Tetraeder-Tetrade der Ericaceen (Abb. 1), und vergleichen sie mit den Tetraeder-Tetraden von paläozoischen Pteridophyten (wie sie sich wiederholt in Dolomitknollen, aber auch in Mazerationsprodukten gefunden haben). Die monoleten Sporen der Pteridophyten kommen für diesen Vergleich nicht in Betracht.

Der im Mittelpunkt der Tetraeder-Tetrade liegende Ort jeder Spore ist der Apex (Abb. 2). Von ihm gehen die drei Kanten der ± pyramidenförmigen Proximalhemisphäre der Sporen aus. Auf diesen drei Pyramidenkanten entwickelt sich bei den trileten Sporen der Pteridophyten die Vorrichtung, welche sich bei der Keimung

[1] Ein Beispiel hierfür ist die nicht nur auf unrichtiger Arbeitsmethode, sondern z. T. auch noch auf falscher Beobachtung beruhende Arbeit von H. D. Pflug (Palaeontographica 1953). Präparate Pflugs haben uns vorgelegen.

öffnet. Beim tricolporaten Ericaceenpollen jedoch (Abb. 1) lässt sich in der Tetraeder-Tetrade zwar der Ort genau feststellen, welcher der Lage der Y-Marke der trileten Sporen der Gefäss-Kryptogamen enstpricht, eine Keimstelle wird an diesem Ort aber nicht mehr ausgebildet, sondern anderswo. So jedenfalls ist es bei dem typischen tricolporaten Angiospermenpollen, mit dem allein gewisse Eigenschaften paläozoischer Sporen und Pollenkörner verglichen werden sollen. Hier entstehen die Keimstellen nach „Fischers Gesetz" (Wodehouse 1935) zu je zweien an sechs Punkten der Tetraeder-Tetrade (vergl. auch Erdtman 1952, S. 14).

Nicht in Betracht ziehen dürfen wir u. a. den triporaten Pollen der Proteaceae, einer unter den Angiospermen noch immer nicht an ganz sicherem Platz eingereihten, eine Sonderstellung einnehmenden Familie. Hier bilden sich die als Poren ausgebildeten Keimstellen nach „Garsides Gesetz" (Erdtman l. c.) zu je dreien an nur vier Punkten der Tetrade, nämlich an den Enden der Y-Linien (vergl. auch Garside 1946). Die Keimapparate haben hier also nicht die morphologische Lage, welche sich bei dem typischen tricolporaten Angiospermenpollen zeigt, vielmehr ist die Lage hier noch als pteridophytoid zu bezeichnen. Ein Entwicklungsweg, der von paläozoischen Sporen zum Proteaceentyp führen würde, könnte also nicht als ein Weg zu einem typisch angiospermiden Bauplan bezeichnet werden. Zudem soll ja im folgenden gerade nur davon die Rede sein, ob man gewisse Eigenschaften paläozoischer Sporen mit denen tricolporater Pollenkörner vergleichen könne. Hier jedenfalls gilt der Satz: Die Keimstellen des tricolporaten Angiospermenpollen sind denen der trileten Sporen nicht homolog (vergl. Erdtman, l. c., Abb. 3, Potonié 1934 u. a). Gewisse Wandlungen also, die man im unmittelbaren Bereich der Y-Marke fossiler, trileter Sporen oder an der Y-marke selbst beobachten würde, könnte man niemals als eine Tendenz zum tricolporaten Angiospermenpollen betrachten, sie müssten als weitere Besonderheiten der trileten Marke aufgefasst werden. Selbst wenn sich grosse Ähnlichkeiten mit angiospermiden Keimapparaten zeigen sollten, würde es sich um nichts anderes als Konvergenzerscheinungen handeln.

Die bezeichnende Eigenschaft des tricolpaten und tricolporaten Angiospermenpollen nämlich ist es, dass seine Keimapparate, schon in der Pollenmutterzelle oder aber später in der Tetrade, nicht im Bereich der Pyramidenkanten (s), sondern entfernt vom Apex

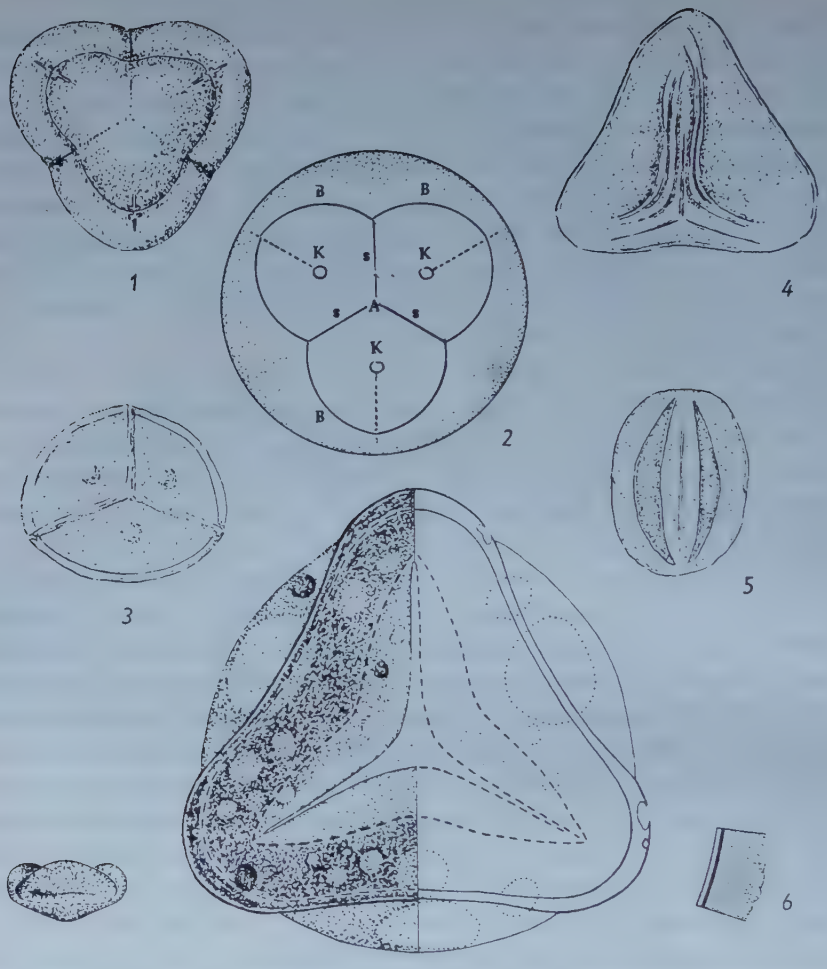

Abb. 1—6. — 1: Ericaceen-Tetrade. An dem mittleren, zu oberst liegenden Pollenkorn ist ersichtlich, dass der morphologische Ort der Colpen ein anderer ist als der der punktiert eingezeichneten, weil nur von innen durchschimmernden Y-Linien. — 2: Schema einer paläozoischen Pteridophytenspore. A: Apex; K: Kontaktpunkte; s: Y-Strahlen; B: Curvaturae, die Kontaktareen einschliessend. Punktierte Linien: morphologischer Ort der Entstehung der angiospermiden Merkmale. — 3: Megaspore, bei der auf den Kontaktpunkten flache kleine beulenförmige Ausbauchungen der Exine erscheinen. — 4: „*Poroplanites*-Einfaltung" einer trileten Spore. — 5: Medulloseen-Spore. Erscheinungsbild im durchfallenden Licht. — 6: *Hemitelia maxonii*. Palynogram (nach G. ERDTMAN, unveröff.). × 1000.

auf den Kontaktareen (K) erscheinen. Denken wir uns den Ort dieser Germinalien auf eine Pteridophytenspore übertragen, so würde seine Verbindungslinie mit dem proximalen Pol der Spore den Winkel zwischen den Y-Strahlen halbieren (Abb. 2, punktierte

Linie). Nur auf dieser Halbierungslinie hätten wir nach Charakteren zu suchen, die als Vorläufer des tricolporaten Pollen zu deuten wären. So könnte man z. B. auf die Tatsache aufmerksam machen, dass bei manchen Pteridophytensporen die Kontaktareen eine dünnere Exine haben. Es kann auch erwähnt werden, dass Zierelemente wie Warzen, Coni usw. auf den Kontaktareen nicht oder weniger entwickelt sind als auf der übrigen Exine und dass die Kontaktareen manchmal äquatorwärts vorstreben. Das gilt für Mega- und Mikrosporen, von denen jedoch für unsere Überlegungen nur letztere in Frage kommen. Weiter kann auf die ± in der Mitte der Kontaktareen gelegenen Kontaktpunkte aufmerksam gemacht werden (Abb. 3). Als Kontaktpunkte bezeichnen wir die Punkte, an denen sich die vier Sporen der Tetrade berühren, wenn sie in der Mutterzelle noch ± der Kugelgestalt entsprechen. Diese Kontaktpunkte zeigen sich bei der fertigen trileten Spore manchmal als kleine beulenförmige Ausbauchungen der Exine (Abb. 3), die ± in der Mitte der Kontaktareen stehen. [Nur weil dies bei den Megasporen besser zu beobachten und dort auch anderen Autoren aufgefallen ist, sei es nebenbei erwähnt. Es sei besonders *Bentzisporites* (*Triletes*) *tricollines* (ZERNDT), eine Selaginaceenspore aus dem Oberkarbon genannt.]

Aber all solche Dinge können nur Bedeutung gewinnen durch ihre Beziehung zur topographischen Lage des Keimapparats rezenter tricolporater Pollenkörner. Bei der Tetraeder-Tetrade des Ericaceenpollen ist dieser Ort leicht festzustellen (Abb. 1). Der Colpus schneidet hier die Curvatura senkrecht an der Stelle, wo sich die Curvatura am meisten dem Äquator des Pollenkorns nähert. Die Keimstelle befindet sich am Schnittpunkt von Colpus und Curvatura, sie liegt der Curvatura an.

Wollte man also irgendwelche Löcher, die sich ja in der Exoexine (Sexine) fossiler ebenso wie rezenter Pteridophytensporen manchmal finden, für Homologa der Keimstellen des tricolporaten Angiospermenpollen halten, so dürfte man nur solche Löcher in Betracht ziehen, die sich auf dem die Kontaktarea halbierenden Meridian befinden, besonders auf der Strecke zwischen dem Kontaktpunkt und dem äquatornächsten Punkt der Curvatura.

Löcher in der Exoexine (Sexine) sind für sich allein noch keine angiospermische Eigenschaft. Wir nehmen als Beispiel Sporen der rezenten Cyatheaceen-Gattung *Hemitelia*. Die Spore von *H. grandifolia* zeigt in der Exoexine (Sexine) in der Nähe der Y-Strahlen

einander gegenüberstehende, durch die Strahlen voneinander getrennte Löcher. Diese haben keine zum Vergleich mit den Keimporen des tricolporaten Pollen erforderliche Position. Je eine grössere luftgefüllte Aufblähung des Exospors jedoch befindet sich nahe dem Äquator der Spore, genau in der Mitte zwischen den Enden der Y-Strahlen. Diese drei Aufblähungen hätten die morphologisch zu fordernde Lage, wenn man überhaupt an eine Beziehung denken wollte. Zum weiteren Vergleich sei auch auf *Hemitelia maxonii* (Abb. 6) verwiesen.

Dieselben Überlegungen müssen auf *Poroplanites porosinuosus* (Pflug 1953) und ähnliche Fälle angewandt werden. Die „Poren" und sonstigen angeblich „tricolporaten" Merkmale erscheinen hier im Zusammenhang mit den Y-Strahlen, womit es von vornherein entfällt, diesen zudem sehr fragwürdigen Charakteren irgendeine Bedeutung für den Werdegang tricolporater Eigenschaften beizumessen. Man würde die Grundlage morphologischer Betrachtungsweise verlassen und zeigen, dass man vom Wesen solcher Arbeitsweise nichts weiss.

Was als *Poroplanites* im weiteren Sinne bezeichnet worden ist, ist ein Erhaltungszustand einer trileten Spore, die im aufgeblähten Zustande von ± kugelförmiger Gestalt war. Es lassen sich bis zum *Poroplanites*-Zustand viele Übergänge finden (siehe Potonié und Kremp, 1954, Taf. 4, Fig. 3, aber vor allem Potonié und Kremp, 1954 *b*). Bezeichnenderweise ist denn auch der *Poroplanites*-Zustand nicht nur im Karbon, sondern in den verschiedensten Formationen gefunden worden. Er kehrt durch die Ergeschichte immer wieder (Abb. 4).

Beim *Poroplanites*-Zustand ist die vorher ± kugelig aufgeblähte Wand zwischen den Y-Strahlen eingedrückt worden, im extremsten Falle so weit, dass sich die einander gegenüberliegenden Wandflächen aneinander gelegt haben. Manchmal sind nur die Wände beiderseits eines einzigen Y-Strahlens stärker eingedrückt. *Poroplanites* ähnelnde Bilder ergeben sich auch wo die trilete Spore im Sediment lediglich ± schräg oder von der Seite plattgedrückt worden ist. Auch hierbei drängen sich die Falten ± parallel, dicht am Y-Strahl zusammen

Solche Übergangsstadien sind auch von Dulhunty (aus dem Perm) und von Jersey (aus Perm und Trias) abgebildet worden. Bei den extrem eingefalteten Exemplaren (dem typischen *Poroplanites*-Zustand) erscheint der Äquatorschnitt der Exine unter Um-

Abb. 7. *Schopfipollenites* Potonié und Kremp, Mikrospore einer karbonischen Medullosee. Oben rechts proximal, links distal, unten Querschnitte senkrecht zu den Falten. Im auffallenden Licht.

ständen als Y. Der Meridianschnitt zeigt ± die Form der Abbildung 4. Es ist verständlich, dass die Exine bei dieser Einbuchtung sich gerade längs der Y-Strahlen, da diese etwas starrer sind, ± fältelt und lädiert. Diese Falten nun dürfen und können nicht als „angiospermide" Eigenschaften angesprochen werden. Vor allem darf man die Räume, die sich unter ihren Sätteln bilden, nicht für Aufblätterungen von Exinenlamellen halten. Primäre oder sekundäre Löcher, die eventuell vorhanden wären, verlieren damit noch mehr die vermutete Bedeutung (man vergleiche den oben erwähnten Fall von *Hemitelia*).

Auch wenn man, wie dies geschehen, bei den bisaccaten Formen nach Übergängen zum tricolporaten Angiospermenpollen sucht, darf man nicht von Umgestaltungen der trileten oder monoleten Marke ausgehen. Will man zu mehr als Irrtümern gelangen, so geht es auch nicht, allein mit Hilfe der Sporae dispersae Entwicklungsreihen aufzustellen. Auf diese Weise lassen sich die allerverschiedensten Reihenfolgen konstruieren, zumal wenn man, wie dies geschehen, auch noch Gleichzeitiges einbezieht. Aber selbst die Tat-

sache der chronologischen Folge genügt nicht. Man kann Entwicklungsreihen mit einigem Erfolg nur bei denjenigen Sporen aufstellen, deren Mutterpflanzen man kennt, also bei in Fruktifikationen gefundenen Sporen. Und die Reihenfolge hat sich dann aus der Diskussion nicht nur der Sporengestalt, sondern aus dieser im Zusammenhang mit den von der Pflanze sonst noch gebotenen Eigenschaften zu ergeben.

Ich habe früher darauf hingwiesen, dass Sporen, wie sie den Medulloseen eignen (Abb. 7) — und in noch höherem Grade, wegen ihrer Kleinheit, jene ähnlich gebauten vom *Zeilleria*-Typ — wenn man sie unter den Sporae dispersae antrifft, bei flüchtiger Betrachtung mit tricolpatem Angiospermenpollen verwechselt werden können (Abb. 5). Es handelt sich um Sporen von ± ovaler Gestalt. Die Exine zeigt drei der Längserstreckung der Spore folgende lange Falten (Abb. 7), von denen zwei einen grösseren Einschlag haben und einander genähert sind. Sie liegen beiderseits von einem meist etwas aufgeblähten Sektor, dem Bulbo (Abb. 7, links oben), auf dem distalen Teil. Der Bulbo befindet sich bei den im Sediment flachgedrückten Exemplaren zumeist auf der Mittelinie. Ihm parallel auf der Mitte der Gegenseite ist dann die dritte, der monoleten Marke entsprechende Falte. Diese ist nur sehr schwach ausgebildet, so dass sie als Furche bezeichnet worden ist. Sie findet sich manchmal mit offener Sutur und kann auf ihrer Mitte einen Geniculus aufweisen.

Renault hielt den Umbo für die Keimstelle. Schopf verneint es und gibt diese Funktion der kleinen Furche der Gegenseite. Florin (1937) kommt auf Renaults Meinung zurück. Mag auch die schmale Furche der proximalen monoleten Marke gewöhnlicher Sporen entsprechen, so bezeichnet Florin dennoch den Bereich zwischen den beiden ihr gegenüberliegenden tiefeingeschlagenen Falten als die „Germinal-Furche".

Schon 1933 hat uns nur die beträchtliche Grösse von *Schopfipollenites ellipsoides* (Ibr.) verhindert, auf die Ähnlichkeit dieser Pollenkörner mit manchen rezenten Dreifaltpollen aufmerksam zu machen. Kleinere Typen des Bauplans *Schopfipollenites* indessen, wie sie z. B. zu *Zeilleria* gehören, könnte man bei oberflächlicher Betrachtung leicht für angiospermische Dreifaltpollen halten, bei denen die dritte Falte durch die Abflachung des Korns im Sediment nicht recht erkennbar oder ausgeplättet wäre. Wie Querschnitte von *Dolerotheca*-Pollen aus Dolomitknollen zeigen, ist hier die dritte

Falte von Anfang an weniger tief (vgl. SCHOPF 1949, Taf. 108, Figur 4, 5, Tafel 114, Figur 15).

Über den Bau der inkohlten Medulloseen-Spore haben uns Querschliffe aufgeklärt, deren Ergebnis Abb. 7 unten ist. Die beiden grossen Falten sind bei den in der Kohle ausgeplätteten Sporen dicht angedrückt. Zwischen ihnen ist die Wandstärke der Exine nicht geschwächt. Der Umbo ist nur schwach entwickelt. Die auf der Gegenseite liegende Falte ist nur als sehr schwache Rinne zu erkennen. Bei manchen der von KREMP quer geführten Dünnschliffe waren beide oder auch nur eine der breiten Falten nach der entgegengesetzen Seite umgelegt (Abb. 7 unten). Die Beobachtungen wurden beim successiven Herunterschleifen der Sporen durchgeführt und entsprechen den Vermutungen, welche man bereits bei Betrachtung von IBRAHIM's Original haben konnte. Man muss feststellen, dass IBRAHIM's Zeichnung von 1933, Tafel 4, Figur 29, richtig war. Die proximale kleine Falte oder Rinne kommt schon deshalb nicht für den Vergleich mit dem Colpus eines tricolpaten Pollenkorns in Frage, weil sie nach den Autoren der monoleten Marke der Sporen homolog ist. Die beiden anderen Falten aber bilden als Ganzes einen Keimapparat, der allenfalls mit dem monocolpater (monosulcater) Pollenkörner zu vergleichen wäre.

REISSINGER (1935) meint, im Saarkarbon „Dreifaltenpollen" gefunden zu haben. Dieser Pollen müsste gründlich mit den soeben besprochenen Typen verglichen werden. REISSINGER schrieb mir jedoch, dass er keine Präparate aufbewahrt habe. Seine Photos können nicht als Dokumente gelten; ähnliche Photos lassen sich auch von Medulloseensporen machen.

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ÜBER EIN MASSENVORKOMMEN VON SCIADOPITYTES-NADELN IN KOHLIGEN ABLAGERUNGEN DES OBEREN JURA ODER WEALDEN DER SPANISCHEN OST-PYRENÄEN.

VON

WALTHER GOTHAN.

Mit Bemerkungen von Fr. Thiergart.

Von dem deutschen Geologen Dr. K. J. Müller[1] wurden aus den Ost-Pyrenäen verschiedene Pflanzenfossilien mitgebracht, von denen ein Teil in kalkig-mergeligen Schiefern liegt, die dort als eine Art von „lithographischer Schiefer" abgebaut wurden. Diese enthalten eine sehr sonderbare fossile Flora, die schon früher mehrfach Beachtung gefunden hat und zwar schon 1902 von Zeiller bekanntgemacht wurde, zusammen mit dem spanischen Geologen Vidal. Vor kurzer Zeit ist dann von Josefa A. Menendez darüber etwas erschienen (1951), die ähnlich wie Zeiller als Fundort Santa Maria de Meyá, Provinz Lérida, Katalonien, angibt. Der von der genannten angeführte Fundort Rubies ist derselbe wie Santa Maria, wie Herr Dr. Müller mitteilt. Der Fundort liegt in der Nähe des Ortes Ager am Südhang des Monsech-Gebirges, wo die als Kimmeridge bezeichneten Ablagerungen auf ca. 10 km im Streichen zu verfolgen sind. Auf jeden Fall gehören also die Ablagerungen dem obersten Jura an.

Ausserdem brachte aber Dr. Müller ein kohliges Material mit, das in dünnen Platten als schiefrige-kohlige Ablagerungen spaltet und etwas den Eindruck einer Wealdenkohle macht, jedenfalls aber in eine ähnliche geologische Stufe gehört, wie das vorgenannte kalkig-mergelige Material. Die genannten schiefrigen Platten waren

[1] Diesem Herrn danke ich bestens für Vermittlung der einschlägigen Literatur und für einige Auskünfte über die lokalen Ablagerungsverhältnisse.

beim Abbau fortgeworfen worden; es kommt damit noch eine bessere Kohle vor, die abgebaut wurde. Es wird sich vielleicht lohnen, diese Kohle noch petrographisch zu untersuchen, was aber in der vorliegenden Arbeit noch nicht geschehen ist. Wir haben es hier nur mit den schiefrigen, kohligen Schichten zu tun. Um die Aufsammlung aller der genannten Materialien, die auch z. T. eine reiche Insektenfauna enthalten, hat sich doch besonders Herr Dr. med. Condal verdient gemacht, der auch Herrn Dr. Müller im Gebiet geführt hat.

Die in Frage stehende „Kohle" besteht aus dünnplattigem, offenbar von Schiefer durchsetztem Material und lässt schon mit blossem Auge erkennen, dass darin eine grosse Menge von kleinen flachen Nadeln steckt, die sich auch ziemlich leicht herausnehmen lassen (vgl. Taf. I, Fig. 1 links und 2). Ausserdem sind noch andere ledrige, mehr bandförmige Pflanzenteile darin, von denen hier nicht weiter die Rede sein soll. Die genannten Nadeln erregten meine Aufmerksamkeit deswegen, weil man bei genauerer Betrachtung sieht, dass die beiden Seiten der Nadeln verschieden gebaut sind. Die eine Seite ist glatt, die andere Seite zeigt bei einigermassen guter Erhaltung eine deutliche breite Mittelriefe, die in einigen Fällen eine deutliche Rauhigkeit aufweist. Es entstand bei mir der Verdacht, dass es sich um eine Struktur handelt, wie sie von *Sciadopitys*-Nadeln bekannt ist. Derartige Nadeln sind ja schon seit der Juraformation bekannt und mit dem Namen *Sciadopitytes* Halle belegt worden. Die Mazeration der Nadeln zeigte die Richtigkeit dieser Vermutung. Sie wurden von Frl. R. Rettschlag präpariert, die ihrerseits auch die *Sciadopitys*-ähnliche Struktur erkannte. Die Oberhaut der Nadeln ist vollkommen gleichmässig aus länglichen Zellen ohne Stomata aufgebaut (Taf. I, Fig. 3); die Unterhaut zeigt, dass in der Mittelriefe die Stomata sitzen und dass ausserdem zahlreiche Papillen vorhanden sind, wie sie die *Sciadopitys*-Nadeln besitzen. Sie erscheinen im Querschnitt als runde Körper (Taf. I, Fig. 4 oben links). Beim Umlegen der Papillen zeigen sie sich wie in Taf. I, Fig. 5. Die Epidermis ist hier an der Grenze der Mittelriefe der Länge nach abgerissen, und man sieht am Rande sehr deutlich die genannten Papillen herausragen. Es kann kein Zweifel darüber sein, dass es sich um Nadeln von *Sciadopitys*-Struktur handelt. Ob dieselbe Gattung wie heute vorliegt, lässt sich nicht beantworten, ebenso wie bei den sonst aus dem Jura bekannten Nadeln, für die man daher ja den Namen *Sciadopitytes* Halle benutzt.

An sich wäre also das Vorkommen derartiger Nadeln nichts besonders Neues. Aber es ist doch interessant, dass hier die Nadeln in so grosser Menge zusammen auftreten, dass diese Vorfahren von *Sciadopitys* eine Rolle als Kohlenbildner gespielt haben müssen, da es sich in den anderen etwa gleichaltrigen mesozoischen Formen um Einzelfunde handelt. Es ist merkwürdig, dass sich in sonstigen pflanzenführenden Ablagerungen dieser Periode, insbesondere in den vielfach kohlenreichen Ablagerungen von Wealden-Alter bei uns keine Spur derartiger Pflanzen findet; in unserer reichen Wealden-Flora fehlen sie jedenfalls vollständig. Im nordwestlichen Nordamerika, wo ja die untere Kreide ebenfalls als Kohlenformation eine grosse Rolle spielt, scheinen ebenfalls derartige Funde zu fehlen. Da *Sciadopitys* in der deutschen Braunkohle als Braunkohlenbaum offenbar zeitweise eine grosse Rolle gespielt hat, ist das Auftreten als kohlenbildende Pflanze in früherer Zeit nicht gerade verwunderlich. Ich entsinne mich, dass ich einmal z. B. in der Braunkohle der Grube Zukunft (Miozän) bei Düren ganze Bündel solcher Nadeln gesehen habe. Nach den Untersuchungen von Thiergart u. a. sind Pollen dieser Gattung besonders in gewissen Schichten der Braunkohlen häufig, und schon vorher hatte Menzel sie in der westlichen Fortsetzung dieser Braunkohlen bei Herzogenrath festgestellt. *Sciadopitys* ist in ihrem jetzigen einzigen Vorkommen im heutigen südlichen Japan ein Baum der Montanregion, und wenn sie in der Braunkohle häufig war, so hat sie dasselbe Schicksal geteilt, wie z. B. die Sequoien, die ja früher zur älteren und jüngeren Braunkohlenzeit im Humus der Braunkohlen-Waldmoore vegetierten, während sie heute als Bäume der Montanflora fortleben. Bis zu einem gewissen Grade kann man das auch von der Fichte (*Picea excelsa*) sagen, die ja auch heute noch stellenweise als urwüchsiger Moorbaum vorkommt, im allgemeinen aber Gebirgsbaum geworden ist. Dasselbe gilt auch gewissermassen für das Schicksal gewisser Kautschukbäume, die im Torfhumus der älteren eozänen Braunkohle als Moorbäume vorkamen, heute aber nicht mehr als Torfbildner in den tropischen Urwäldern fortexistieren. Ein Teil dieser tertiären Kautschukbäume dürfte von den Vorfahren der *Ficus elastica* herrühren, es scheinen aber noch andere Arten dabei gewesen zu sein. Es sollte hier einmal wieder auf diesen Wechsel der Standortsbedingungen hingewiesen werden, für die es noch mehr ähnliche Beispiele gibt.

Wir haben nun eine sehr schöne kurze Darstellung der bis dato

bekanntgewordenen *Sciadopitytes*-Funde gerade aus den mesozoischen Perioden von Herrn Florin, dem dieser Band als Jubilar gewidmet ist. Er zählt verschiedene Arten auf aus dem Tertiär, aus der mittleren und unteren Kreide, aus dem oberen und mittleren Jura und sogar aus dem Rhät (Pålsjö). Namentlich die untere Kreide Grönlands scheint mit die meisten Funde geliefert zu haben. Demgemäss spricht er die Meinung aus, dass die *Sciadopitineae* einen Kulminationspunkt bereits in der unteren Kreide erreicht hatten. Das vorliegende Material dürfte diesen Eindruck noch mehr bestätigen.

Was nun die systematische Stellung von *Sciadopitys* betrifft, so hat Florin in der genannten Arbeit, nach seinem Zitat auch schon Velenofsky betont, dass es sich um einem isolierten Koniferen-Typus handelt, der die Aufstellung einer besonderen Familie *Sciadopityaceae* rechtfertigen würde. Pilger (Nat. Pflanzenfamil., 2. Aufl. S. 347) hebt ebenfalls hervor, dass die Gattung ein isolierter Typ ist, und ähnliche Bemerkungen finden sich sicher noch bei anderen Autoren. Dafür sprechen die Strukturverhältnisse der Doppelnadeln, die paläobotanischen Umstände und, was ich hier noch dazu hervorheben möchte, die sehr eigenartige Holzstruktur, die weder mit den Araucarieen, noch mit Taxodieen, unter denen die Gattung immer noch herumgeschleppt wird, etwas zu tun hat, wie die grossen Eiporen[1] der Markstrahltüpfel zeigen, auf Grund deren man auch einige Holzfunde hat sicher identifizieren können, die allerdings in der Braunkohle trotz der Häufigkeit der Nadeln, der Pollen nur einige Male gemacht worden sind (Rhein. Braunk. nach Jurasky, Zarrentin in Pommern durch Verfasser in einem isolierten kleinen Braunkohlenvorkommen). Man scheut sich offenbar, wegen dieser einen Gattung eine besondere Familie aufzustellen, wie es ja ursprünglich auch mit *Ginkgo* der Fall war, der zu den Taxaceen gezogen wurde. Die Familie *Ginkgoaceae* existiert in der Literatur, seitdem die fossilen Vorkommen die Sache richtig beleuchtet haben. Florin betrachtet übrigens das Schicksal der Ginkgoaceen als eine Parallele zu dem der Sciadopityaceen. Es ist doch wirklich schon öfter vorgekommen, dass man für ausgefallene einzelne Gattungen besondere Familien aufstellen musste, wie die *Cercidiphyllaceae* und *Eucommiaceae*, und im vorliegenden Fall ist die Sache vielleicht noch eklatanter.

[1] Solche Eiporen kommen noch bei einigen Podocarpeen vor (vgl. Gothan 1905, S. 56), womit aber wegen der sonstigen Eigentümlichkeiten von *Sciadopitys* ebenfalls gar keine Verwandtschaft bestehen kann.

Nun finden sich in der betreffenden Kohle nach den vorläufigen Feststellungen von R. Rettschlag eine ganze Anzahl von Pollen, aber keine von *Sciadopitys*. Die Pollenführung wurde ausserdem noch von Dr. F. Thiergart untersucht, der ebenfalls keine fand. Er stellt mir über die Funde von *Sciadopitys*-artigen Pollen das Folgende zur Verfügung:

„Der ähnliche Pollen habe ich erstmals im oberen Rhät von Helmstedt gefunden (Thiergart, Palaeontogr. 89 B, S. 12, Taf. 2, Fig. 6 u. 8). Der Pollen ist gröber strukturiert und dürfte mit unserer heutigen Art nicht übereinstimmen, wie auch ein Exemplar aus dem Dogger (l. c. Taf. 2 Fig. 25, Bl. Degow), das grösser und feiner strukturiert ist und vielleicht eher mit *Tsuga* verglichen werden kann. Die Formen verschwinden in der Kreide.

Weyland und Greifeld (1953) haben *Sciadopitys*-Pollen kürzlich als *Sp. serratus* aus dem untersenonen Ton von Quedlinburg abgebildet, der hier von weiterher eingeweht sein dürfte, wie wir das aus dem Oberoligozän vor Beginn der eigentlichen Einwanderung her kennen.

Kirchheimer hat aus eozänen oberrheinischen Salzablagerungen neben vermutlichen echte *Sciadopitys*-Pollen bekannt gemacht, und Reissinger aus dem Ypernton (Eozän). Nach meiner [Thiergarts] Meinung liegt in beiden Fällen Meeresferntransport vor und zwar aus nördlicher Richtung; die Gattung war anscheinend autochthon im nördlichen Skandinavien und Sibirien. Kirchheimer hält sie jedoch für autochthon im Eozän. Dazu ist zu bemerken, dass unter den Tausenden von eozänen Pollen aus dem Geiseltal und von Zeitz-Weissenfels keine derartigen Pollen von mir gefunden wurden.

In der Kölner und Lausitzer Braunkohle wurden erstmalig Pollen und Nadeln gefunden, so dass die Autochthonie hier bewiesen ist. In der Bitterfelder Kohle und im Liegenden der Kölner Braunkohle fanden sich nur sehr vereinzelte Pollen, offenbar eingewehte Stücke. In der Mitte des rheinischen Braunkohlenflözes und im Lausitzer Unterflöz steigt die Häufigkeit plötzlich scharf an und bildet in beiden Gebieten mehrmals kleine Gipfel; die Pollen werden dann hier und im Lausitzer Oberflöz, wenn auch nicht häufig in allen Proben gefunden, wie auch im mittleren Miozän von Mecklenburg. Im Pliozän (Westerwald) wird der Pollen örtlich etwas häufiger und verschwindet endgültig im oberen Pliozän."

Es mag auf den ersten Blick merkwürdig scheinen, dass sich in den schiefrigen Kohlen oder kohligen Schiefern von Santa Maria

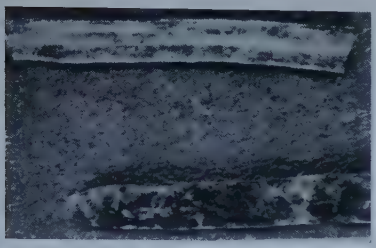
trotz der Häufigkeit der Nadeln keine Pollen des Typus gefunden haben. Das erklärt sich aber aus der offenbar allochthonen Ablagerung der kohligen Schiefer, bei denen nach dem Aufbereitungsprozess die leichteren Objekte wie Pollen weiter forttransportiert worden sind. Ob sie sich in der eigentlichen Kohle des Fundorts finden, wird sich später herausstellen, wenn diese Kohle untersucht werden kann. Vor der Hand müssen wir uns mit der Feststellung eines Massenvorkommens von Nadeln zufrieden geben. Das Alter der vorliegenden Ablagerungen ist jedenfalls ähnlich wie das der Kome-Schichten von Grönland und auch des oberen Jura von Andö (Lofoten), in denen nach Florin und Johansson die Nadeln besonders zahlreich gefunden sind, weshalb er ja seinerseits einen Höhepunkt der Entwicklung der Gattung annimmt. Weshalb in den sonstigen Wealden-Ablagerungen sich keine Sciadopityten gefunden haben, lässt sich nicht beantworten; vielleicht waren die betreffenden Pflanzenassoziationen anders. Vielleicht kann man sie in dem Kootenay-Schichten von Nordwest-USA und Canada noch finden.

Zusammenfassung und Schluss.

Aus den Ost-Pyrenäen wird ein Vorkommen von zahlreichen *Sciadopitytes*-Nadeln aus dem Oberen Jura (oder der untersten Kreide) beschrieben, wo die Gattung offenbar als Kohlenbildner aufgetreten ist. Von einer spezifischen Bestimmung der Nadeln wird abgesehen, da ein genauer Vergleich mit den zahlreichen neuen Sp. von Florin noch nicht recht möglich ist, da er seine Mitteilung von 1922 als vorläufig bezeichnet hat, und die Angabe einer „Species" nicht besonders wichtig scheint. Mir genügt vorläufig die Bezeichnung als *Sciadopitytes* sp. (? n. sp.).

Nachtrag.

Nachträglich hat Dr. Thiergart unter den Pollen des Materials doch noch einen solchen vom Charakter der *Sciadopitys*-Pollen gefunden (Taf. I: 6), die aber offenbar in dem Material sehr selten sind. Dies erklärt sich aus der Zusammenschwemmung des Materials, wobei also Nadeln und Pollen verschieden weit verschwemmt worden sein können. Vielleicht ist der Pollen auch eingeweht.



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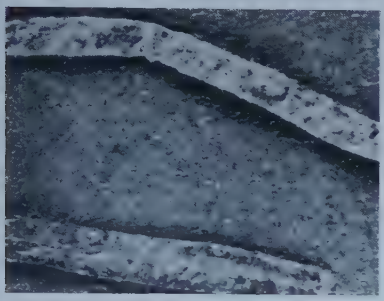

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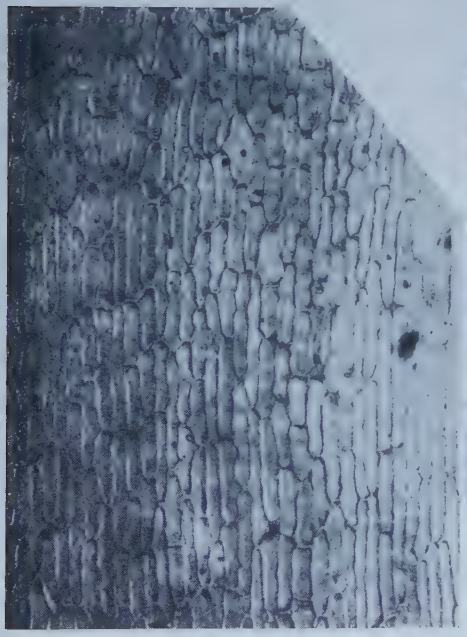

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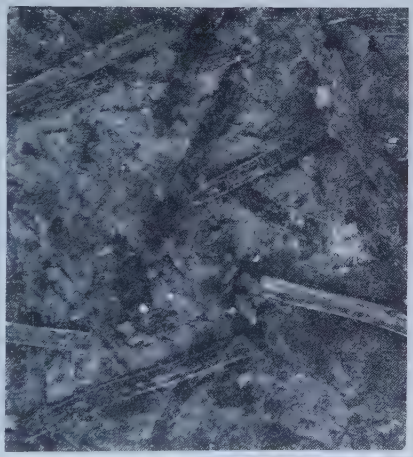

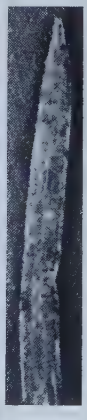

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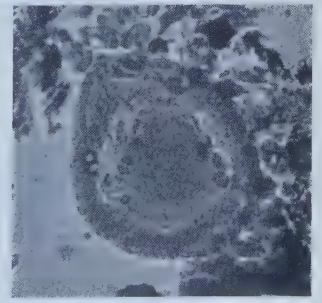

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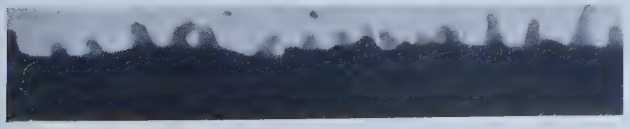

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Tafelerklärung.

Zu *Sciadopitytes* sp. Nordspanien, Ob. Jura oder Wealden.

Fig. 1—2. Ansicht der Nadeln in 1/1 und 3/1.
Fig. 3. Oberepidermis in ca. 60/1.
Fig. 4. Unterepidermis mit Stomata-Zeile und Papillen (ca. 100/1).
Fig. 5. Papillen seitlich gesehen (ca. 100/1).
Fig. 6. *Sciadopitytes*-Pollen aus der Kohle, ca. 500/1.

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PALÄOBOTANISCHE EINDRÜCKE IN SÜD- UND SÜDWEST-AFRIKA.

VON

RICHARD KRÄUSEL.

(Forschungs-Institut Senckenberg, Frankfurt a. M.)

Als ich meinen zuständigen Heimatstellen vor Jahresfrist den Plan einer paläobotanischen Studien- und Sammelreise durch Süd- und Südwest-Afrika vorlegte, wurde mir entgegengehalten, dass diese Gebiete doch wohl nur wenig dazu beitragen könnten, neue Ergebnisse zu erzielen, die den Aufwand an Zeit und Mitteln rechtfertigen würden. Ähnliche Ansichten traten mir dann auch im Lande selbst entgegen. Ich hielt und halte sie für falsch, und meine bisherigen Eindrücke haben mich darin nur bestärkt. Im Grunde hätte es schon genügt, auf die überraschenden Ergebnisse früherer Untersuchungen hinzuweisen. Ich schreibe diese Zeilen fern von allen literarischen Hilfsmitteln und bin daher nicht in der Lage, das Gesagte durch erschöpfende Aufzählung und genaue Zitate zu belegen.

Die organischen Einschlüsse der zahlreichen altpaläozoischen Kalke sind noch keineswegs erschöpfend untersucht, ebenso ist es mit der psilophytalen *Dutoitia* und dem eigenartigen *Cyclodendron* aus den Witteberg-Schichten, die mit manchen der gleichen Gattung zugewiesenen Resten aus Brasilien nichts zu tun haben. Die *Glossopteris*-Flora wie die jüngeren mesozoischen Floren galten nach den Arbeiten Sewards und Dutoits als erforscht. Dass dies jedoch nicht zutrifft, lehrten überraschende Einzelfunde, wie die durch H. Thomas beschriebenen Formen von Pteridospermen-Verwandtschaft (*Umkomasia* usw.) oder die jüngsten Angaben Frau Plumsteads über fruchtende *Glossopteris*-Blätter, die sie dem Sammeleifer des Herrn LeRoux in Vereeniging, Transvaal, verdankte. Mir scheint es, als habe diese Entdeckung nicht die ihr gebührende Beachtung gefunden. Mit ihnen beiden konnte ich die Fundstelle

besuchen und glaube, dass seit langem kein Fund von ähnlicher Bedeutung gemacht worden ist. Das soll nicht heissen, dass ich mir alle Deutungen Frau Plumsteads zu eigen mache. So halte ich die eigenartigen Gebilde, deren organischer Zusammenhang mit den Blättern ausser Zweifel steht, nicht für die weiblichen, sondern die männlichen Organe und sage voraus, dass auch jene bei Vereeniging zum Vorschein kommen werden, ja vielleicht bereits gekommen sind, zusammen mit einer ganzen Reihe neuer und bisher unbekannter Formen.

Besonders reich ist Süd- und Südwest-Afrika an fossilen Hölzern, auch aus Rhodesien liegen solche vor. Die mesozoische Gymnospermen-Liane *Rhexoxylon* ragt unter ihnen besonders hervor. Sie finden sich vom Permokarbon an durch alle Schichten bis in das Tertiär, besonders zahlreich im älteren Mesozoikum. Fast in jedem Museum liegen mehr oder weniger zahlreiche Stücke, meist als *Dadoxylon africanum* bezeichnet. Aber niemand hat sich bisher der Mühe unterzogen, sie einmal näher zu untersuchen, obwohl ich bereits 1928 für die Hölzer Südwest-Afrikas nachweisen konnte, dass ihr anatomischer Bau recht verschieden ist und sie zum Teil zu den Mesoxyloideen gehören. Bei meinem Bestreben, davon möglichst viele zusammenzubringen, habe ich hier überall, bei amtlichen und wissenschaftlichen Stellen, bei Sammlern und Farmern bereitwillige Unterstützung gefunden. Ergänzt wird dieses Material durch die Stücke einer ganzen Reihe von Museen und Instituten, die sie mir leihweise zur Untersuchung überlassen haben. Über die Kreidehölzer aus der Umgebung von Port Elizabeth und von der Mündung des Umzamba im nordöstlichen Pondoland (östl. Kapland) war bisher so gut wie nichts bekannt. Sie umfassen Farne, Gymnospermen, Mono- und Dikotyledonen, unter diesen allem Anschein nach auch Dipterocarpaceen. Die tertiären Hölzer von East London wiederum dürften mehr als eine Konifere enthalten.

Neben diesen Hölzern sollten Blatt- und sonstige Reste nicht übersehen werden. Hier wird sich die Kutikular-Analyse als besonders fruchtbar erweisen, deren Wert nicht zuletzt durch die grundlegenden Arbeiten Florins zur Genüge erwiesen ist. Auch Pollen- und Sporenanalyse findet ein weites, noch unerschlossenes Arbeitsfeld, sei es in ihrer Anwendung auf die älteren Kohlen, sei es für jüngere und jüngste Schichten. Für diese freilich ist es — wie auch anderwärts — mit morphologischer Beschreibung und mehr oder weniger phantasievoller Benennung nicht getan. Jeder Versuch

botanischer Bestimmung aber setzt die Kenntnis der lebenden Pollenformen voraus. Und bis dahin ist es angesichts der Artenfülle der heutigen Flora Südafrikas noch ein weiter Weg. Aber die ersten Teile des Pollen-Atlas von Zinderen-Bakker sind bereits erschienen.

Ich glaube, dass die lebende Flora des Gebietes auch für die Florengeschichte anderer Räume bedeutsam ist. Abgesehen von der Fülle der Arten ist sie durch die grössten Unterschiede in deren Verbreitung ausgezeichnet, auch wenn man die in historischer Zeit durch den Menschen verursachten Veränderungen unberücksichtigt lässt. Viele ihrer Formen sind ohne Zweifel sehr alt. Dies gilt nicht nur für Cycadeen (*Stangeria, Encephalartos*) und Koniferen (*Widdringtonia, Podocarpus*) mit ihren Verwandten im europäischen Tertiär, sondern auch für manche Angiospermen. Hier seien nur die Proteaceen genannt, an denen Südafrika heute so reich ist. Man hat dieser Familie bekanntlich früher einen grossen Anteil an der europäischen Tertiärflora zugeschrieben (v. Ettingshausen: „Neuholland in Europa!"). Dann aber sind alle diese vermeintlichen Proteaceen zu *Myrica* und anderen gestellt worden. Die gleichen Blattgestalten sind hier wie dort vorhanden, Gewissheit kann daher aus ihnen allein nicht gezogen werden. Aber auch da hilft die Kutikular-Analyse weiter. Sicher ist, dass einige der vermeintlichen Proteaceen mit ihrer Hilfe einwandfrei als Myricaceen erkannt werden konnten. Damit ist freilich noch nicht erwiesen, dass gleiches auch für alle übrigen gilt. Proteaceen-Holz kennen wir aus Nordafrika, wo es zusammen mit anderen Formen vorkommt, die auch aus Südeuropa bekannt sind. Die Möglichkeit also, dass auch in Europa während der Kreide, ja noch im Alttertiär Proteaceen gelebt haben, ist zwar unbewiesen, kann aber auch nicht als widerlegt gelten. Vergleichbare lebende Arten sollte man dann aber nicht wie bisher in Australien, sondern in Afrika suchen. Dahin zielende Untersuchungen sind im Gange.

So eröffnet sich der Paläobotanik in Süd- und Südwest-Afrika ein weites Forschungsgebiet, das mit den modernen Untersuchungsmethoden angegangen werden muss. An ihrem Ausbau hat Florin erfolgreich mitgearbeitet. Darauf in diesem kurzen Bericht aus der Ferne hinzuweisen, war mir ein Bedürfnis. Gleichzeitig danke ich allen afrikanischen Stellen, die meine Bemühungen hier im Lande unterstützt, der Deutschen Forschungsgemeinschaft aber, der Stadt Frankfurt a. M. wie ihrer Universität für die Beihilfen, die meine Reise erst ermöglicht haben.

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AGAIN: THE NEW MORPHOLOGY — ELUCIDATED BY THE MOST LIKELY PHYLOGENY OF THE FEMALE CONIFEROUS CONE.

BY

H. J. LAM.

(Director of the Rijksherbarium, Professor of Botany, Leiden.)

I. The Theory of Stachyospory and Phyllospory.

Having long led the life of an herbarium-taxonomist, after my return to Europe my teaching activities urged me into the side-line of realising "the sense of it all", as Fægri characteristically describes the fundamental and ultimate task of the taxonomist.

Though I never abandoned taxonomic work, it has gradually slowed down, occupied as I was by the duties issuing from the directorship of a growing institute. On the other hand my teaching duties naturally made me return to an old hobby, phylogeny. The first outcome of my reflections as a more experienced man was a paper on phylogenetical symbols (16). Later on, studying groups outside the ones allotted to me from my early years, and studying literature pertaining to them, I felt more and more fascinated by the grand and natural development of phylogenetical ideas which were given quite a shock by the discovery of the *Psilophytales* by Kidston and Lang in about 1917 and which, in 1930, resulted in Zimmermann's telome theory.

Now, I have heard people—not many—say: I do not believe in the telome theory. This is, of course, everybody's good right, and a botanist can perform excellent work in other fields of our unlimited science without this credo. But the telome theory is a primarily and essentially phylogenetic concept, and this is what some people, notably those whose daily work makes them deal with forms, structures, and functions of living plants, seem to find hard to grasp.

To the phylogenetical mind three things are indispensable: a well-poised and unbiased insight in all fields of biology (including his own), a working knowledge of palaeontology (and therefore of historical geology), and an inclination to natural philosophy; in short, the phylogeneticist must have above all a dynamic and synthetic mind.

After all, present-day plants with all their parts, structures and functions must have originated from somewhere. Unless one denies evolution as such—a standpoint we will not discuss here—all living plants must have had ancestors, down to the very beginning of life, and it is the task of the phylogeneticist, however scanty his material may be, to trace two things: lines of descent of recent organisms, and those of their parts, structures and, if possible, life cycles.

Both tasks are extremely delicate and their issues extremely vulnerable. The latter can be criticised, justly or—all too often—unjustly and irrelevantly, by those who lack the synthetic and dynamic mind. The point is where to draw the limits, both taxonomically and morphologically (in a wider sense).

The most hasardous of the two is the connection between present-day and extinct taxa. Even the former are often difficult enough to delimit; as to the latter, our minimal knowledge of extinct taxa makes our task next to hopeless and it can only be performed along gross lines.

The phyleses of single characters, or semophyleses as ZIMMERMANN once termed them, depend on the alleged autonomy of parts, i.e. of homologies which are isolated gene-complexes with all their innate potentialities. Their limits are, of course, often vague and, in addition, they may have changed in the course of time. So long as genetics fail to give us a clear insight into the exact relationship between genes and characters, we cannot hope to go far beyond the stage of subjectivity. But we cannot help trying. And since even teratologica must, somehow, be determined by genetical factors, I feel despite what is, I think, the general modern trend, that they must have some significance—if used judiciously—in the interpretation of homologies, and that many of them betray what is generally known as atavisms.

I declare to be a convinced adherent to the telome theory. This does not mean that I do not fully realise that it is a theory based upon a working hypothesis, viz. that telomes are genetically determined morphological units and that the dichotomical ramification

is the original one, at least in land plants, and possibly inherited as such from their thallophytic ancestors (cf. MARTENS, 25; and CHADEFAUD, 7, 8). But I think it is a very plausible theory well worth to be given a fair chance, which I think it has got in the past 25 years.

To my mind it has revolutionised our morphological concepts, in as far as it has completely reversed the direction of our schemes: the Angiosperm-centred one was—in spite of its remarkable development—fundamentally wrong, phylogenetically speaking; even the most specialised plants should be regarded as ultimate results of long phylogenetical processes, and the fact that we know so much more of recent than of extinct plants, does not affect this principle in the least. This is why I consider the term "New Morphology", which has raised some excitement, justified and adequate. It does of course not belittle the importance of the "old one" in the least; it is the reverse of it and therefore another, and, I think, in this context, a more reasonable and coherent aspect of the same thing.

On the basis of the telome theory I have developed some views which I published in due course (17—22). The main of these is the concept of stachyospory versus phyllospory and their bearing upon our insight in the natural system of the *Cormophyta*, living and extinct. A minor one is the place of *Casuarina* close to the *Gnetales* rather than to the *Monochlamydeae*.

I stated with satisfaction that these views, in spite of their admitted immaturity, were not altogether ignored. I cannot say that they evoked a wide interest and this is only comprehensible both because the world of botanical phylogeneticists—even if augmented by those who unjustly claim to be able sensibly to criticize the subject—is a small one; and because the contribution is nothing but an extension of the telome theory and its contents have partly been enunciated by others in various forms even previously.

New, however, is my theory that the conditions of stachyospory and phyllospory more or less distinctly correlate with accepted taxa, though obviously more so in the lower than in the higher groups; in the latter the two conditions are less sharply distinguishable, probably on account of the wide range in this respect inside the pteridospermous ancestral stock of these higher groups. In fact, the two conditions may be observed in the same species, one in the female, and the other in the male sex. As a rule, however, the condition of phyllospory, which is naturally advanced in comparison with

stachyospory, is prevailing, if it does prevail, in the male, i.e. the generally more exposed sex.

Under these conditions it is not unexpected that the dividing line gets still more vague in the Angiosperms. It is true that certain groups can, entirely or for the greater part, be confidently described as stachyosporous, others as phyllosporous, but still others seem to offer a greater resistance against a discrimination in this respect. I may repeat here that in spite of numerous investigations in the fields of morphology, anatomy, embryology and ontogeny, the Angiosperms are one of the poorest known groups as far as the interpretation of their organs is concerned. "It may well be", says WILSON (34, p. 444) "that our ideas of the phylogeny of the Angiosperms have even now not attained mature form; we are apparently just at the beginning of an understanding of the complexity of structure of the Angiosperm flower. If further progress is to be made ... no line of evidence is to be omitted." In my first paper (17, p. 144) I have given the same admonition; yet BAILEY (1), in referring to it, asked for "a broadened outlook".

Well, then, I got some few letters "in favour" or almost so. Next to that, some botanists did me the honour to refer to my theory more or less circumstantially in a paper, against or in favour, or with certain objections. Let me discuss some of them here, as well as some others which are of interest in this context.

In general, those fully against delivered irrelevant criticism in so far as their trend of thoughts and therefore there argumentation was entirely or largely static, based on anatomical, histological, or ontogenetical "evidence", and, in addition, mainly referred to the Angiosperms which admittedly form the weakest link in my theory. *A purely phylogenetical theory cannot be refuted on ontogenetical arguments alone.* Opponents of this category are, in alphabetical order, I. W. BAILEY, H. BAUM and W. LEINFELLNER, J. E. CANRIGHT, A. J. EAMES, L. VAN DER PIJL, W. ROTHMALER and R. SOÓ. They all referred to my first papers (17, 18), BAUM and LEINFELLNER, and SOÓ, also to a later one (19). The most interesting cases are those of EAMES and of WILSON.

EAMES got quite excited about it; a great honour to me, no doubt, from that quarter. He could easily have ignored the whole thing which would perhaps have been the worthier attitude. For instead, he hastily (it would seem) wrote an "abstract" (9), apparently with the purpose of getting rid of these annoying, revolutionary ideas

once for all. Very soon after, a more circumstantial paper was published (10) which one of his American colleagues described as a "vitriolic attack", apparently written "in the grip of some kind of an obsession". This is a very good description, as everybody can state for himself. But it is not a complete one. Not only are his "arguments" all but phylogenetical, and is his attack mainly directed against the Angiosperm types of placentation, which he thinks to be one of my main points, but the paper teems with irritated quotation marks, misinterpretations and misquotations. It would be a hopeless task to refute his "arguments" one by one; hopeless and useless, for nobody can be convinced who is unwilling to be convinced, even before he is spoken to. Meanwhile, I have accomplished this task for myself, sacrificing many hours, but I am not going to bore the reader with its results, though I will always be prepared to answer any constructive or objective criticism.

The other interesting, though much less unpleasant, case is that of WILSON, apparently a pupil of EAMES's. His first paper (33) on the origin of the stamen on the basis of the telome theory, was published before I published mine. I can agree with his views but in that he, as has been long usual, speaks of "the" Angiosperm stamen. Yet, he seems to feel that some doubt in this respect is not entirely misplaced, for he says (l.c., p. 761): "that the stamen, as well as the carpel, may well have originated not only at different times, but also along different lines".

In his second paper (34), WILSON quotes mine (17). Its subject is the stamen of the *Melastomaceae* and though he fails to extend the correct thought laid down in his earlier paper just quoted, he says (l.c., p. 443): "The filament, together with the connective, may represent, in whole or in part, the main axis of a branch system"; and farther on: "The primitive stamen probably evolved in several directions and underwent numerous modifications." "Even the possibility that (the Angiosperms) are polyphyletic cannot be ignored." I have quoted another remark from this paper above and I find both thoroughly sound.

Then followed WILSON's review of the telome theory (35), only quoting my papers of 1948 (17, 18). Though a fervent adherent of the telome theory and in spite of the ideas expressed in his earlier papers, he now raises (l.c., p. 433) objections to the interpretation of forked veins in Angiosperm leaves as traces of ancient dichotomies (cf. VAN DER HAMMEN, 12; and DE WILDEMAN, 32); but he fails to

give a better one and seems to have fallen back to "static" arguments. Why should the above interpretation be acceptable in ferns, Pteridosperms, Cycads, and Conifers, and not in Angiosperms? He speaks of my "bizarre classification" and concludes: "Lam's papers have been discussed by Eames and so thoroughly refuted that no further consideration need to be given them here." Could some personal influence from the master have made Wilson lose his independent opinion and make this volte-face?

Other opponents are Baum and Leinfellner (2, 3) who claim that stamens and carpels are (mostly) peltate; accordingly, as these peltate carpels (which are supposed to bear ovules) can lead to any type of placentation known, "(verliert) die Unterscheidung zwischen Phyllosporie und Stachyosporie somit jede morphologische Grundlage" (l.c., p. 280). I would agree (provided that the above views are correct), but this is not a morphological, still less an ontogenetical, but a phylogenetical theory and in that case other arguments have to be used.

I cannot forbear from mentioning an amusing discussion between Janchen (14, 15) and Baum (4). Janchen, who is a fervent adherer to Wettstein's views and who piously revivified the detailed though somewhat cumbersome paper of that other adept of the Vienna school, Neumayer (13), disputes Baum's opinion that "the stamen" (among other phyllomes) is fundamentally peltate. Janchen, to be sure, has another theory, which fits in Wettstein's pseudanthium-theory. He reproaches Baum, justly, that she uses ontogenetical evidence in her refutation of his phylogenetical views (14, p. 268), but the irony of the case is that he himself produces only a pseudophylogenetical theory. Whereas the euanthium-theory is still partly based on fossil evidence, the pseudanthium-theory is purely a concept of comparative morphology and therefore not a phylogenetical theory, at least in my sense. Consequently Janchen still expresses the opinion that the Gymnosperms—not, apparently, including the Pteridosperms—are the ancestors of the Angiosperms.

Baum, on the other hand, in her reply (4), admitting that Angiosperm organs must somehow have evolved from older homologa, confuses morphological facts ("Tatsachen") with morphological interpretations and still seems to think that such facts can *prove* a phylogenetical development. I am afraid that both Janchen and Baum are fighting windmills. The least one can expect is a phylogenetical concept which allows to interpret the greatest possible

number of "facts" (i.e. observations) in an harmonic overall picture.

CANRIGHT (6), one of BAILEY's students, discussed the stamens of the *Magnoliaceae* and refers to my first paper (17). He states, incorrectly, that I (among some others) was induced by the telome theory to "completely abandon the older classical concepts, i.e. that stamens are modified phyllome structures" (l.c., p. 484). He quotes EAMES's paper in quiet terms and adds (l.c., p. 491) that "a more specific discussion of the attempted application of the telome theory to angiosperm stamens seems necessary". This is exactly what I have recommended. He objects against using the bifid filaments of some *Monochlamydeae* as arguments in favour of a primitive condition and says (l.c., p. 492) that "various authors have clearly and conclusively (sic) shown (sic) that the members of the *Amentiferae* are highly evolved in all organs". This recalls some of the milder passages in EAMES's paper, and in spite of the "many authors" I know of quite some other many who do not agree. Scientific truth, though, is not fixed by ballot. For the rest, CANRIGHT's arguments mainly refer to anatomy, ontogeny and Angiosperms. The same can be said of VAN DER PIJL (27) who discusses the case of the *Ricinus* stamens. His criticism is based on ontogeny only and is therefore irrelevant.

ROTHMALER (29), quoting my first paper (17), gives a good and up-to-date review of the phylogenetic relationships of the "*Spermatophyta*". He cannot agree with my theory as far as the Angiosperms are concerned, since they are "too uniform" ("einheitlich"); I have discussed and answered this point in some of my more recent papers (19, 20, 22); see also below.

DE WILDEMAN (32) who discusses whether or not the dichotomy of leaf nerves is an ancestral character, and concludes, on ontogenetical grounds, that there is no reason to believe so, refutes PARROT (26) who is of the opinion that such dichotomies are phylogenetically significant. The same view is held by BERTRAND (5) regarding bifid filaments (quoted by CANRIGHT, 6).

Recently the Hungarian taxonomist R. SOÓ (30) who apparently switched over, of late, to dialectic materialism, stating that plant phylogeny was actually born in Russia (GORJANINOW, 1841) and that the MICHURIN-LYSENKO doctrine is the only correct one in genetics, pronounces himself in favour of the euanthium concept. As has been done by some others he thinks that I consider the Angiosperms a biphyletic group. I admit that my earlier papers may have

made this impression but my later ones (notably 20) unambiguously state that the double fertilisation must have been at the bottom of all ancient Angiosperms and that this group must, from this point of view at least, be considered monophyletic.

He, like EAMES, asserts that the central placenta of the *Centrospermae* can as well be interpreted as the ultimate result of valve carpels which, in fact, seem apparent in young stages. This ontogenetical "evidence", however, does not prove that they actually *are* true carpels (with marginal ovules) and not false involute carpels (pseudocarpels), as I think they are (cf. 20, fig. 15).

Coming to those in favour of my views or fostering similar opinions, I have first to mention that RIZZINI (28) kindly suggested to review my ideas in Portuguese and is therefore probably one of my adherents.

Two authors who could not or did not refer to my work, expressed similar opinions. In an interesting review, FRENGUELLI (11) states that if, as we must believe, the Angiosperms rooted in the Pteridosperms, we have to use phylogenetical arguments (l.c., p. 206—207). We have to "abandonar la teoría clásica de la morfología floral para aceptar, por lo menos en parte, la hipótesis rameal" (l.c., p. 206). Basing his views on the telome theory he concludes that we may expect to find three types of organs—photosynthetic (i.e. sterile), mixed, and exclusively reproductory.

The other author is MÄGDEFRAU (24) who believes that it is possible to maintain both the euanthium- and the pseudanthium-theory (l.c., p. 327). In his diagram (l.c., p. 328) he hesitatively connects the "*Angiospermae* (*Ranales*)" with the *Caytoniales* as members of the Pteridosperms which also developed the *Cycadopsida*. The "*Angiospermae* (*Monochlamydeae*, p.p.)" are hesitatively connected with the *Coniferopsida*, which rooted in Upper Devonian *Protolycopsida* which, in their turn, sprung from Upper Silurian *Psilophyta*. These views are very close to mine, as well as to those expressed in the second part of this paper. Curiously enough, the *Gnetales* are omitted from MÄGDEFRAU's diagram, perhaps a consequence of the facts that the author is a palaeobotanist and that fossil *Gnetales* are hardly known.

Two other papers refer to mine. MAEKAWA (23), quoting my paper (18), arrives with a perfectly different method at similar views and subdivides the *Cormophyta* into two groups: *Stelopsida*, and *Phyllopsida*. The differences with my subdivision into *Stachyosporae* and

Phyllosporae are slight, but many groups are yet to follow in later papers envisaged by Maekawa.

Suessenguth and Merxmüller (31) agree that the Angiosperms must be at least "biphyletic" and unreservedly accept my theory and main subdivision, stating that the Angiosperms have still to be thoroughly investigated in their respect. My papers (17—19) are quoted.

II. The Phylogeny of the Female Coniferous Cone.

It seems very appropriate to elucidate the above views by an example which has a direct bearing on the work of Prof. R. Florin, to whom this fascicle is dedicated on the occasion of his 60th birthday. Florin has, by his accurate and splendid work on *Cordaitales*, *Coniferales* and *Taxales*, conclusively solved a problem which has, for more than a century, given rise to much controversy.

This controversy was started by Robert Brown in 1827. Among the many who took part in it the names of Schleiden (1839), Alexander Braun (1853), Baillon (1860), Sachs and Cas. de Candolle (both 1868), van Tieghem (1869), Eichler (1873), Čelakovský (1882), and Masters (1890—1893) may be recalled.

As recently as in 1930, Zimmermann still put the classical, Angiosperm-centred, question: flower or inflorescence? He tried to reconcile the two by accepting a non-committal "Schuppenkomplex" which comprises the bract and the "ovuliferous scale". Some years later Hirmer (lastly 1936; Bibl. Bot. 114, 1) put the clock backwards in comparing this "Schuppenkomplex" with certain types of *Sphenopsida* in which fertile parts (sporangiophores) are attached immediately either underneath or above sterile ones. This led him to the erroneous conclusion that the "Schuppenkomplex" had to be regarded as a serially split phyllome, whose upper part was fertile (cf. W. Troll, Ber. D. bot. Ges. 51, 1933, 21).

Accordingly, in Hirmer's opinion the female coniferous cone should be a "flower" rather than an "inflorescence". The idea that there is a fundamental dichotomy is correct but the autonomy of the "Schuppenkomplex" has been overrated by him. In this instance the correct answer is clear. In my opinion, that same answer is probably applicable to various serial and collateral duplications in Angiosperm flowers, viz. they are essentially dichotomies; and it is not surprising that parts of such structures are fertile.

The drama approached its end when HAGERUP, between 1933 and 1939, published his papers on Conifers and their alleged place in the ancestry of Angiosperms (Biol. Meddelels. X—XV). These papers present a queer mixture of excellent observations, clear pictures and more or less likely conclusions. One of the latter was equally Angiosperm-centred, in so far as the need was felt to discover a "macrosporophyll" at any price. Of course it was found — in science and imagination everything can be found if one tries hard enough—; it was found in the integument of the ovule.

In my paper of 1948 (17) I recognised the ovuliferous scale as an axillary structure of axial nature and in those cases in which it is broad and flattened I proposed to call it a cladosporophyll which I considered a sort of secondary sporophyll, with the nature of a cladode (l.c., p. 133).

Full victory, however, was brought about by FLORIN, who summarised and polished the results of many detailed investigations since 1938 in his Harvard lectures and published these in his well-known and justly admired paper of 1951: Evolution in *Cordaites* and Conifers (Acta Horti Bergiani 15, N:o 11, 1951, 285—388).

This paper is the key-stone to the problem under discussion and many of its fascinating reconstructions have already found their way in botanical literature (e.g. ROTHMALER, 29). Some few of them have been brought together in the diagram accompanying the present paper. They have been somewhat simplified and the whole picture needs little explanation.

Before ending by saying a few words about it, I cannot help saying a few others regarding FLORIN's paper just quoted. FLORIN is very cautious and carefully avoids too much speculation. It is psychologically interesting to state how strongly he is, in some cases, attached to—one would even say, dominated by—the antiquated (and often hesitating) terminology, even to the extent of causing confusion. This holds particularly for the use of terms like "megasporophyll" and even "flower". What FLORIN calls a "megasporophyll" in these groups covers what I would choose to term an ovulum, i.e. megasporangium with its cover of an integument (originating, apparently, from two sterile telomes); my remark also refers to the term "sporophyll" generally, e.g. in the case of *Cordaitales*, whose "lateral struc-

Fig. 1. Possible phylogeny of the female coniferous cone. In 8 the limits between *V* and *D* have been indicated by an interrupted line. *V* = ovuliferous scale; *D* = bract; *B* = Upper; *O* = Lower; *Krijt* = Cretaceous; *H* = hypothetic.

Lycopsida
Dreparophy-
cus
etc
1
2
3
4
5
6aI
6aII
6bI
6bII
H
Psilophytales (Sil.–Dev.)
cf. Baragwanathia (Sil.)
Cordaitales (Carb.–Perm)
Lebachia
fossiel
recent
Araucaria
Picea
6aIII
Coniferales
Pseudovoltzia
(O. Perm)
Lebachia
(B. Carb – O. Perm)
Ernestiadendron
(B. Carb.–O. Perm)
Swedenborgia
(O. Jura)
Dreponolepis
(O. Krit)
Sequoia-
dendron
Cupressus
Cryptomeria
Araucaria
Pinus
Thujopsis
Abies
Picea
D
V
♂
♀

tures" in the reproductory shoots of both sexes are either sterile or fertile, either simple or compound, but apparently never bearing an axillary shoot (no more than the "sporophylls" in the male coniferous strobilus) and therefore of a different nature than, say, other phyllomes of the same plant, and, for that matter, all Angiosperm phyllomes (whatever this term may be worth in the "New Morphology"); for fertile organs I would rather have preferred a term like sporangiophore. But all this is, of course, if not irrelevant, certainly of very little consequence.

Since FLORIN, in his concluding chapter, only hesitatingly applies the telome theory, I tried to conceive a reconstruction. Of course, diagrams like these are always oversimplified. They represent, so to say, the current-thread of the genorheithrum (the hologeny of ZIMMERMANN, applied to taxa, not to a series of individual life-cycles).

In the lines of descent there are only two or three gaps of some substance; these have been filled up by hypothetical transitional forms (H). The first and second (Figs. 4 and 5) are linking the oldest Lycopsids of the *Baragwanathia*-type with the (heterosporous) *Cordaitales*; the third (Fig. 6a II) represents the link between the erect *Cordaites* microsporangia and the abaxially recurved microsporangia of some recent Conifers.

Both are consequences of processes of contraction and zygomorphy in the reproductory region. The former are to be interpreted as expressions of a protective principle regarding organs of vital importance, and this can only be effectuated if they have selective value, which it is clear they have.

The gaps inside the Conifers are almost non-existent. Consequently, Botany can now boast of a still longer series of "orthogenies" within a taxon—or should we say phylon—than the "statehorse" of Zoology. Prof. FLORIN and the botanical world are to be congratulated on this great achievement.

Leiden, 5 April 1954.

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SUR LES GINKGOALES ET QUELQUES RAPPROCHEMENTS AVEC D'AUTRES GROUPES SYSTÉMATIQUES.

PAR

L. EMBERGER.

(Institut de Botanique, Montpellier, France.)

Les recherches de notre élève R. Nozeran[1] nous ont fait connaître, chez les Gymnospermes *vivantes*, le mécanisme réductionnel dont les structures ramifiées de l'appareil reproducteur (Exemple: *Cephalotaxus*) sont le siège, pour aboutir finalement à un axe simple, portant, ou non, à la base, des feuilles stériles; au sommet, il y a des feuilles fertiles ♂ (étamines) ou ♀ (ovules). Cette structure réduite est strictement homologue d'une fleur 1-sexuée, à périanthe scarieux, quand il y a des bractées basales (Exemple: *Juniperus communis*). Il existe donc des cônes-fleurs et des cônes-inflorescences, différences sur lesquelles O. Hagerup avait déjà attiré l'attention[2] (Fig. 1).

Il est permis de déduire de ces observations qu'elles sont l'expression de la phylogénèse de l'appareil reproducteur des Gymnospermes.

Les beaux travaux de R. Florin concordent avec ces observations.[3] Ils ont montré que, dans le domaine des Conifères fossiles, la même loi des réductions morphologiques peut être constatée, au moins quant aux cônes ♀: dans les cônes ♀ de *Lebachia*, genre de Conifère

[1] Recherches qui vont être publiées prochainement dans la thèse de Doctorat ès Sciences de l'auteur.

[2] Zur Organographie u. Phylogenie d. Koniferen-Zapfen. — *Det Kgl. Danske Vidensk. Selskab, Biol. Medd.*, 7, 1933.

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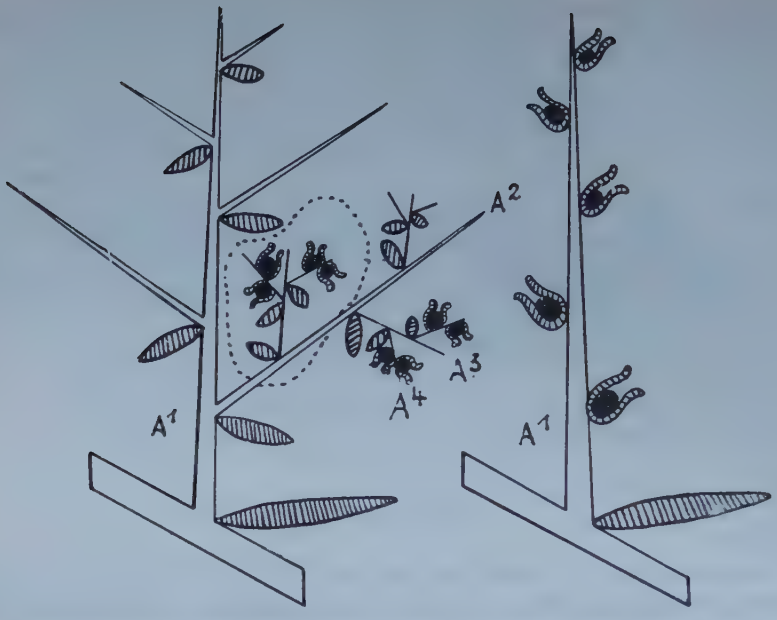

Fig. 1. Le stade initial d'une inflorescence partielle ramifiée au 4e degré (à gauche), et le stade final (à droite). — A gauche, le schéma représente un cône inflorescence; à droite, un cône simple, homologue d'une fleur ♀ nue.

authentique des plus anciens (Stephanien), les bractées des cônes axillent des rameaux secondaires nettement individualisés et feuillés, 1—2 feuilles supérieures étant fertiles, tandis que chez les Conifères plus récentes, ces axes secondaires sont plus ou moins réduits, aplatis, avec leurs pièces ± concrescentes, transformées en « écailles » — la fameuse « *écaille* » des descripteurs. L'individualité des axes-écailles peut même être complètement perdue, comme c'est le cas chez certaines Taxodiacées (*Athrotaxis*) et chez les Araucariacées.

Chez les espèces vivantes, où tous les phénomènes réductionnels peuvent être observés; ceux-ci semblent se dérouler dans un grand désordre, mais cette anarchie n'est qu'apparente, car R. Nozeran a montré que la plus grande régularité est observée dans la succession des divers stades de la simplification.

Le processus est toujours le suivant:

Quel que soit le degré de ramification — le maximum constaté (5° degré) étant chez *Cephalotaxus* — la réduction débute régulièrement par les ramifications ultimes. Les étapes sont les suivantes (Fig. 2, *a—j*):

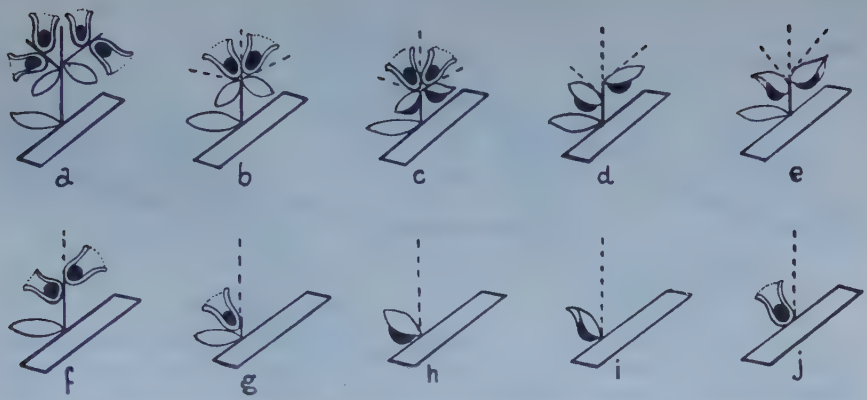

Fig. 2. Étapes successives de la réduction morphologique et du transfert de la fonction sporogène à une feuille d'un axe d'ordre inférieur (voir texte). — Le point de départ est la ramification encadrée d'une pointillé de la Fig. 1. (Inspiré des travaux de R. Nozeran.)

1) réduction de l'axe ovulifère, quant à sa longueur et au nombre des ovules; on aboutit, par exemple, à la structure indiquée sous *a* (*a*);
2) ovule solitaire à l'aisselle de la bractée qui axillait le rameau dans la figure *a* (*b*);
3) la fonction sporogène est progressivement transmise à la bractée; au début, il y a, à la fois, un ovule axillaire « épiphylle » et une ébauche de nucelle mégasporange hypophylle. — Cas dits anormaux (*c*—*d*).
4) La transmission est réalisée complètement par la disparition de l'ovule « épiphylle » et l'enveloppement du nucelle-mégasporange hypophylle; il en résulte une structure à rameau de degré inférieur au précédent (*e*—*f*).
5) La cycle recommence par l'étape 1, et ainsi de suite ... (*f*—*j*).

Le terme est l'axe simple ovulifère, homologue d'une fleur, signalé plus haut (Fig. 2, *j* et Fig. 1 à droite).

Ceci dit, voyons maintenant le *Ginkgo* (*G. biloba*). La morphologie de l'appareil reproducteur ♀ des Ginkgoales ont fait l'objet de travaux récents de la part de R. Florin[1], R. Nozeran[2] et Emberger[3].

[1] The morphology of *Trichopitys heteromorpha* Sap. — *Acta Horti Bergiani*, T. 15, N° 5, 1949.

[2] Les rameaux courts reprod. de *Ginkgo biloba*. — *Rec. Trav. Inst. Bot. Montp.*, 4, pp. 68—75, 1949.

[3] La position systématique du *Ginkgo biloba*. — *C. R. Ac. Sc.*, Paris, 229, pp. 961—963, 1949.

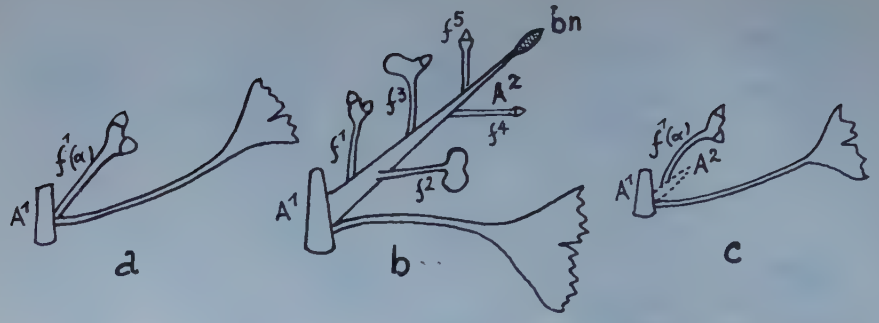

Fig. 3. Valeur morphologique du pédoncule ovulifère de *Ginkgo biloba* (d'après Nozeran). *a:* le pédoncule biovulé habituel; *b:* une « anomalie » observée; *c:* schéma interprétatif du pédoncule habituel. Le pédoncule ovulifère est ici une feuille bisporangiée. A^1, A^2 = les axes; *bn* = bourgeon terminal; f^1, f^2 . . . les feuilles successives.

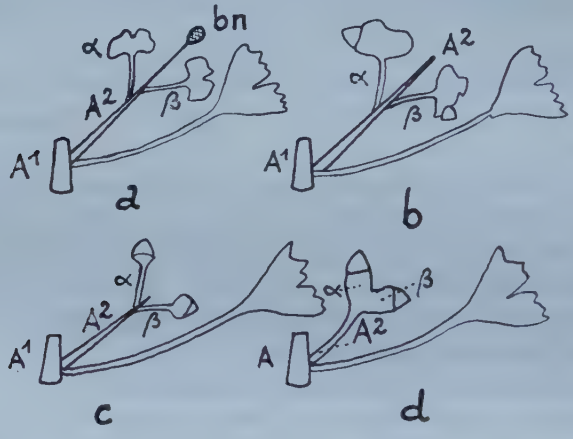

Fig. 4. Origine d'un pédoncule biovulé de *Ginkgo biloba* ayant la valeur d'un axe secondaire (A^2) portant deux feuilles (α et β) fertiles; *bn* = bourgeon, *a:* stade initial; *d:* stade final; *b, c:* stades intermédiaires. (Inspiré des travaux de R. Nozeran.)

Encore ici les recherches de R. Nozeran, qui ont pu être faites grâce à des remarquables cas «anormaux», ont été décisives (Fig. 3). Notre élève a constaté, à la place du pédoncule biovulé axillaire classique (Fig. 3, *a*), des axes terminés par des bourgeons authentiques et portant, à la fois, des pédoncules biovulés, des pédoncules 1-ovulés, des feuilles bilobées ayant un lobe est fertile, enfin, des feuilles bilobées stériles (Fig. 3, *b*). Le pédoncule est, suivant la conclusion de R. Nozeran, une feuille, lorsque l'axe secondaire *avorte quasi totalement*, ne laissant subsister qu'une seule feuille dont les 2 lobes portent un mégasporange (Fig. 3, *c*). Mais, il peut aussi être un axe secondaire à *sommet avorté*, portant, en position

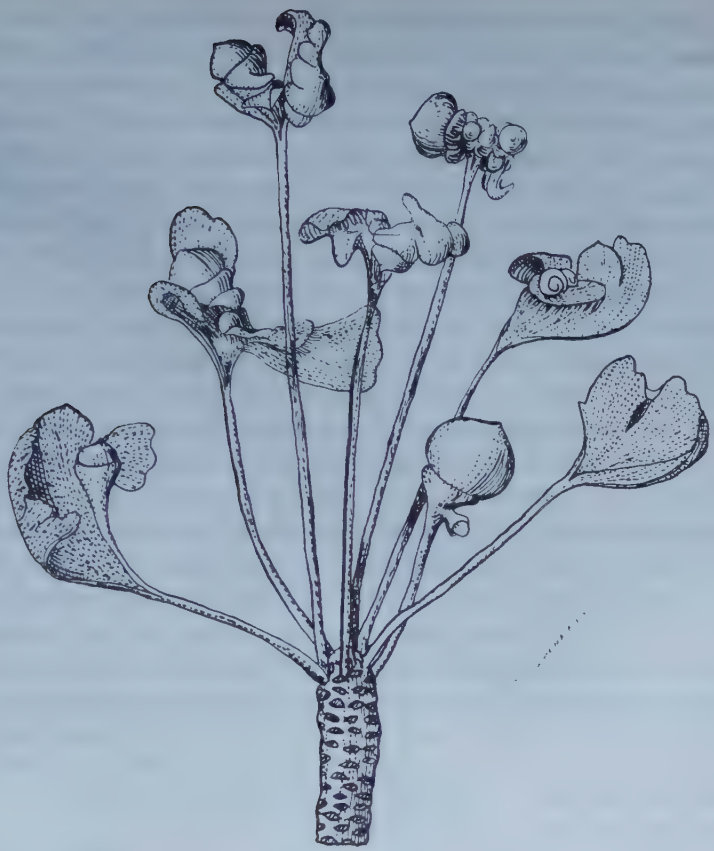

Fig. 5. Rameau court ♀ de *Ginkgo biloba* (d'après Fujii, *in* Pilger). — A droite, on voit une feuille sans sporanges et un pédoncule ovulifère qui est son homologue.

croisée de 2 préfeuilles (α et β), deux feuilles 1-sporongiées. Les figures 4 *a—d* illustrent ces faits.

Or, il est assez fréquent d'observer, chez le *Ginkgo*, que les rameaux courts portant les organes ♀ présentent des «anomalies», lesquelles ont contribué à jeter le désarroi dans la recherche de l'explication de l'appareil ♀ de cette Préphanérogame, alors qu'à la lumière de ce qui a été observé chez les Conifères, elles deviennent très claires et s'insèrent dans une succession d'étapes de transformation identique à celles décrites plus haut.

Dans ces structures «anormales» (Fig. 5), les feuilles vertes, fonctionnant habituellement comme bractée, sont sporogènes et n'axillent plus qu'exceptionnellement des pédoncules ovulifères. Leur

signification est maintenant claire: elles expriment un transfert de la fonction sporogène à la feuille (bractée) sous-jacente. Généralement le transfert est incomplètement réalisé, en ce sens qu'on ne voit pas souvent — si même le cas a déjà été observé — que toutes les feuilles d'un rameau court ♀ soient transformées en ovules. On peut penser que, théoriquement au moins, cette transformation totale peut avoir lieu. Il y a dans l'ouvrage de PILGER[1] une belle figure dans laquelle une feuille végétative est nettement remplacée par un appareil ovulifère; nous l'avons reproduite (Fig. 5).

Supposons que toutes les feuilles d'un rameau court ♀ de *Ginkgo* soient devenus ovules, le rameau primitif, au lieu d'être un système ramifié, sera simple, constitué par un bouquet d'ovules pétiolés. Que les pétioles disparaissent, et ce rameau sera homologue d'un cône ♀ de *Juniperus* sect. *Oxycedrus*, particulièrement de *J. communis*.

Le rameau court ♀ normal de *Ginkgo* est donc homologue d'un cône ♀ de Conifère, comme nous l'avons affirmé déjà en 1944[2]; il est une inflorescence, dans laquelle les appareils biovulés sont les fleurs ♀, ce que confirme aussi FLORIN[3], mais par un chemin un peu différent de celui que nous avons suivi. Les transformations précitées conduisent ce cône-inflorescence vers l'état de cône-fleur.

Ces faits et ces considérations permettent peut-être de mieux comprendre l'organisation de certaines Gymnospermes disparues, telles que les Bennettitales et les Pentoxylées.

Un rameau court ♀ de *Ginkgo* dont toutes les feuilles, au lieu d'être assimilatrices, sont ovulifères, sans produits axillaires, ressemble beaucoup à une «fleur» ♀ de Bennettitale, sauf qu'il n'est pas pourvu d'écailles interséminales. On peut donc se demander, si l'organe reproducteur des Bennettitales n'est pas homologue d'un tel rameau «anormal» de *Ginkgo*. S'il en était ainsi, les ovules pédonculés des Bennettitales seraient des feuilles et, les écailles interséminales en seraient également, mais stériles. L'ensemble serait une fleur.

La question se pose aussi, si le corps ♀ des Bennettitales dont la structure est si extraordinare, ne peut pas être considéré comme un

[1] *in* ENGLER et PRANTL, Pflanzenfamilien, 2° Edit., T. 13, p. 104, 1926.

[2] L'homologie des organes reproducteurs femelle de *Ginkgo biloba*. — *Bull. Soc. Bot. Fr.*, 89, pp. 243—244, 1942.

[3] *loc. cit.*

organe réduit, simplifié, par un mécanisme comparable à celui constaté chez les Conifères et *Ginkgo*. L'ovule pédonculé pourrait représenter, dans ce cas, une ancienne bractée axillant un axe secondaire ovulifère, bractée à laquelle aurait été transféré la fonction sporogène, le rameau axillé ayant disparu. Compris ainsi, le cas des Bennettitales paraîtrait moins extraordinaire; ces végétaux auraient un organe ♀ d'un type répandu chez les Gymnospermes et représenteraient un type très évolué d'un phylum éteint.

L'inflorescence des Pentoxylées pourrait être expliquée de la même manière, sauf qu'elle serait homologue de plusieurs rameaux ovulifères simplifié de *Ginkgo* et non d'un seul, comme chez les Bennettitales.

Bien entendu, ces notes n'ont pas la prétention de résoudre le problème de l'origine et de la signification des structures ♀ des Bennettitales et Pentoxylées, mais les découvertes récentes chez les Ginkgoales et les Conifères permettent de l'aborder sous un angle nouveau et, par conséquent, de le reprendre et de le sortir, peut-être, de l'impasse dans lequel il se trouve.

Je suis heureux de dédier ces lignes à M. le Professeur R. Florin, dont les magnifiques travaux sur les Gymnospermes fossiles sont fondamentaux pour la connaissance de ces végétaux.

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NOTES ON THE NOEGGERATHIINEAE.

BY

T. G. HALLE.

In 1928 F. Němejc published the first conclusive evidence that *Noeggerathia* Sternberg (1823–26) and *Noeggerathiostrobus* O. Feistmantel (1871) belong to a previously unknown group of heterosporous pteridophytes, which differ in important respects from all recent plants. (These two names stand for vegetative and reproductive parts of specimens which may belong to the same natural species.) Later (1931) he proposed the name *Noeggerathiales* for this group, regarding it as equal in taxonomic rank to the *Filicales*, *Lycopodiales* etc. An extensive critical account, adding important information on new or imperfectly known related forms, was published by M. Hirmer (1940) in "Palaeontographica". Hirmer emphasized the relation to the ferns and placed the group, under the name *Noeggerathiineae*, as a subdivision of the *Filicales*. A summary with general discussions followed in "Biologia Generalis" (Hirmer, 1941). — The known distribution of the *Noeggerathiineae* is chiefly confined to the Upper Carboniferous of continental Europe. The investigation of the type genera has been based almost entirely on Bohemian material; as the most important contributions have appeared in paleontological publications, the considerable botanical interest of these plants may not have been generally realized as yet.

The name of the type species, *Noeggerathia foliosa* Sternb., was given to specimens having the appearance of pinnate fronds with obliquely inserted, obovate-obcuneate leaflets. The corresponding fertile specimens were discovered and, on the whole correctly, described by H. B. Geinitz (1865), and were later named *Noeggerathiostrobus bohemicus* by O. Feistmantel (1871). They have the general aspect of cones with two opposite rows of somewhat scale-like concave leaflets (fertile pinnae *or* sporophylls). These are in-

serted transversely (HIRMER, 1940, pp. 5 and 8) by narrow bases, but are very broad, their strongly ascending distal parts extending round nearly half the circumference of the cone. On its upper (adaxial) surface each scale carries numerous large (4×3 mm) seed-like sporangia. The sporangia have often become detached, leaving minute scars which show their arrangement more clearly. (See our textfigs. 1 and 2.)

The *Noeggerathiostrobus* cones were originally attributed to *Noeggerathia* on circumstantial evidence, chiefly the frequent association in the same bed. Confirmation — generally held to be conclusive — was later obtained through the discovery of a cone with a short stalk bearing leaflets resembling those at the base and top of the sterile specimens. (D. STUR, 1878; 1885, pp. 9/12, text-figs. 3, 4).[1] — STUR's figures are those generally used in handbooks to illustrate the characteristic features of the genus; they are reproduced as text-fig. 1 of the present paper in order to facilitate reference in the following discussion.

While STERNBERG interpreted *Noeggerathia foliosa* as the leaf of a palm, most later authors placed the species either among the ferns or in the *Cycadales*.Even after the discovery of the fructification very diverging opinions were expressed. GEINITZ, believing the sporangia to be seeds, even compared the cones to those of the paleozoic conifer genus *Voltzia*.

K. FEISTMANTEL (1879) made the first careful study of the large sporangium- or seedlike bodies. On impressions of broken specimens of these he found some small dark-coloured grains which he — as it later proved, correctly — interpreted as spores; on account of their size (0.8—0.9 mm) he even noted the resemblance to megaspores. These spore-like bodies were also studied by STUR (1885), whose authority caused his descriptions and illustrations to be generally quoted and reproduced in preference to those of the very able account of FEISTMANTEL's. (STUR's illustrations seem to have been drawn from the same sporangia as FEISTMANTEL's figure, if they are not, indeed, mere copies.) — Both these authors placed *Noeggerathia* among the ferns, FEISTMANTEL in the *Schizaeaceae*, STUR in the *Ophioglossaceae*; neither of them seems to have attached great importance to the possible occurrence of megaspores.

[1] STUR concluded that the fertile specimen represented the "metamorphosed" upper part of an ordinary frond; according to most later authors the whole frond was either sterile or sporangium-bearing.

Fig. 1. *Noeggerathia foliosa* Sternb. and *Noeggerathiostrobus bohemicus* O. Feistm. Reproductions of drawings from D. Stur (1878). — *a*, sterile frond, presumably viewed from the upper side; *b*, sporangium-bearing cone; *c*, cone-scale, viewed from the adaxial surface, with three sporangia and scars marking the position of others; *d* and *e*, sporangia with spores. — *a* and *b* reduced, *c* slightly reduced, *d* and *e* somewhat magnified. (For actual size compare Pl. I.)

Feistmantel's and Stur's accounts of the sporangia and spores were not generally accepted as conclusive — chiefly, no doubt, because they were not confirmed by microscopical studies but only based on direct observation of the specimens at low magnification. (In other similar cases supposed spores have proved to be glands, fungal perithecia or other extraneous bodies.)

During the whole period 1879—1927 no new facts of importance came to light. While some handbooks dealt with *Noeggerathia* in connexion with the ferns, a majority among the most competent

authors was more inclined to regard the genus as representing a special group of gymnosperms, related either to the cycads or the pteridosperms (e.g., Zeiller 1900, p. 235; Seward 1910, p. 431; Scott 1920, p. 263; H. Potonié, 1899; Gothan 1921, p. 260). The sporangia were accordingly interpreted either as seeds or, more generally, as pollen-sacs. Gothan (l.c.) suggested that it might be worth while to examine the sporangia with the aid of modern methods of maceration.

Němejc (1928) found on maceration of sporangia from several cones that some of them contained very numerous small spores (0.090—0.130 mm), others a much smaller number of large spores (0.8—1.0 mm), evidently megaspores. The mega- and microsporangia showed no perceptible difference, and both kinds were found to occur in one and the same cone. Němejc's observations, the most definite advance in our knowledge of *Noeggerathia*, seemed clearly to prove the existence of an unknown major group of pteridophytes in the paleozoic flora. But his attempts at explaining the relations of these plants to other groups of pteridophytes were less successful. — In a later paper (1931) he introduced a new morphological interpretation, holding the supposed pinnate fronds to be plagiotropic shoots and the cones true strobili — an idea long before suggested by Seward (1910) and possibly by others. Němejc chiefly based his discussions on the present writer's work on a species of *Plagiozamites* Zeill. and more especially the genus *Tingia* Halle (1927), both from the Permo-carboniferous of China. *Plagiozamites* may indeed be closely related to *Noeggerathia*, as noted especially by Sterzel (1918) and Gothan (1921); but *Tingia* is very different. Neither genus gives additional support to the tentative conclusion finally arrived at by Němejc (1931, p. 114), namely that the *Noeggerathiineae* may occupy a position between the *Articulatales* and the *Lycopodiales*; for several reasons this idea need not even be seriously discussed.

Thanks largely to the assistance of Professor R. Florin, I was able to examine a suitable material of *Noeggerathiostrobus* for the chief purpose of a comparison with Němejc's investigations. During a visit to Vienna in 1931 Florin selected a number of good specimens — from Rakonitz, NW of Prague — in the collections of the Geologische Reichsanstalt, and obtained permission to have them sent to Stockholm, though loans of similar valuable material were not generally granted at that time.

Of 12 cones or cone-fragments 10 were selected for microscopical study. Portions of the carbonaceous substance with entire or fragmentary sporangia were removed from one or several places on each specimen and macerated in the usual way. One specimen yielded no spores. From 8 of the other 9 specimens (one no more than a detached cone-scale) microspores in varying numbers were obtained, occasionally only a few and in one case only one. Megaspores were only found in the material from one specimen, two preparations yielding several spores. On the other hand numerous megaspores were found adhering to the impressions of cone-scales or axis, and even freely scattered in the surrounding rock-matrix. (In the case of the almost complete cone shown in Pl. I, fig. 2, preparations were made from 6 different places, from base to apex.). These observations were somewhat surprising, especially since it could not be stated with absolute certainty that any megaspores came from inside the sporangia. A possible explanation seemed to be that the megasporangia had been emptied before the microsporangia; but it appeared desirable to examine additional material.

On my request Dr. Němejc kindly sent me a good material of carbonized remains from specimens which had yielded numerous megaspores. As he expected, megaspores were found on maceration of several sporangia. By delayed maceration, using somewhat diluted nitric acid and very dilute ammonia (Němejc had used potassium hydroxide), it was possible to make preparations of three sporangia which showed the entire contents of megaspores still surrounded by remains of the sporangium walls — a condition extremely rarely observed on maceration of fern-sporangia. The remains of the sporangium walls were merely thin films showing no cellular structure; it is not known which part of the wall they represent. However, the megaspores could be easily counted and were found to number 16 in each sporangium. (Two of these sporangia are shown, in different magnifications, in Pl. I, figs. 9 and 10.) This number agrees fairly well with what might be expected. K. Feistmantel (1879, p. 8) had counted a maximum number of 9 supposed spores in one sporangium, remarking that their number was probably considerably larger. Hirmer (1941, p. 140), on the basis of the size of sporangium and spores, estimated the number at 32, which was thus not very far from the mark. (It is even conceivable, though scarcely probable, that this larger number may be found to occur in other specimens.) — The results of a cursory examination

of the spores agreed with Němejc's observations, except that the megaspores in the three entire sporangia were found to be somewhat smaller (maximum diameter 0.65—0.75 mm as against 0.80—100 mm in Němejc's material). This difference may indicate that the figured sporangia were not fully developed, the more so as the major diameter of the sporangia, too, seems to have been slightly less than the average.

A few remarks may be added on the morphology of the Rakonitz cones, which were not specially studied from this point of view. From this material, as well as from the illustrations in the literature, it would appear that a decided majority of the compressed fossil cones show only one of the two opposite rows of sporangium-bearing scales. This may mean that the uncompressed cones were oval rather than circular in transverse section (owing to the somewhat flattened shape of the scales); when detached, they would in that case naturally tend to come to rest on one of the somewhat flattened sides and thus show the rows of scales in surface view, If the cone is interpreted as a fertile fern frond (sporophyll), the generally exposed longitudinal halves showing the scales would not correspond to the upper or lower surface of the frond but to its flanks. In any case — whether the cones were flattened or not — the proximal parts of the scales were not extended in a plane passing through the rachis of the supposed (fertile) frond, as are normal pinnae of recent ferns, but were more or less perpendicular to it. — Another detail is the nature of the distal margin of the sporangiferous scale. Stur's well-known drawing (see our text-fig. 1, *c*) shows the margin as being irregularly and rather bluntly duplicato-dentate. Neither in the cones from Rakonitz nor in any photographic illustration in the literature have I noted a similar feature. Němejc (1928, p. 54) speaks of "sharp teeth about 1 mm long", and one of his photographs (l.c., Pl. 1, fig. 4) shows that the teeth at the very top of the cone may reach a length of about 4 mm. Similar teeth may be observed in our Pl.I, fig. 1. Both in this specimen and in the one in fig. 2 they seem to be present at least for some distance below the top. In Pl. I, fig. 6, probably from nearer the base, the teeth are much shorter, but still sharply pointed Němejc has remarked that the scales are mostly badly preserved and therefore do not appear to be "denticulate". It would seem that the teeth generally wither or are broken off at an early stage, with the result that the margin becomes indistinct or appears to be entire.

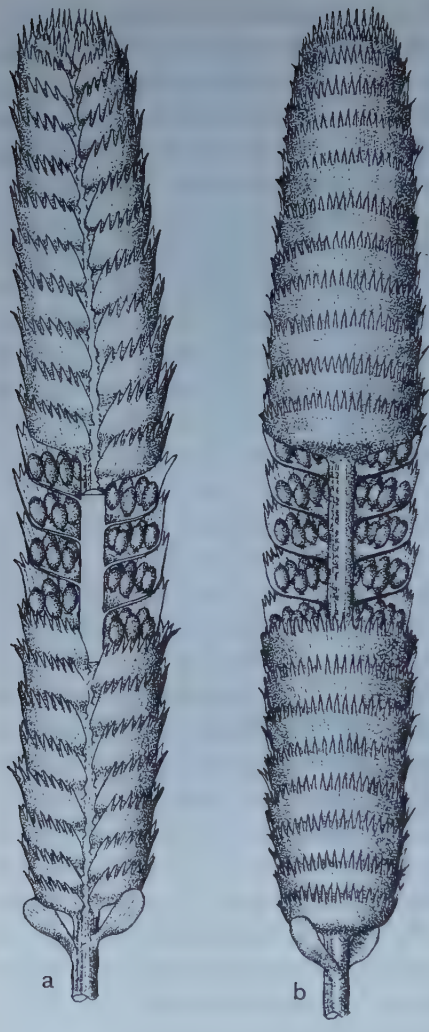


Fig. 2. Tentative restoration of *Noeggerathiostrobus bohemicus*, in two views at right angles to each other. *a* shows a median longitudinal section of part of the cone; in *b* some of the anterior sporangiferous scales have been removed. — Drawings and part of the reconstruction by Mr. K. E. Samuelsson.

Owing to the state of preservation of the cones, scarcely any published photograph or drawing is sufficiently distinct and instructive. Stur's drawing from 1878 and 1885 (our text-fig. 1, *b*) has practically always been used to illustrate the general morphology in textbooks and other handbooks till the present day. In text-fig. 2 an attempt has been made to illustrate the probable appearance of the living cone as presented in two views at right angles to each other. The figures were drawn by Mr. K. E. Samuelsson of the Paleobotanical Department of the Swedish Museum of Natural History. He care-

fully studied and measured available illustrations in the literature and constructed the figure on this basis, with only general directions from the author. However, several features are still uncertain, and the illustrations only purport to convey a general impression, not exact information for the study of details.

My interest in *Noeggerathia* was primarily confined to the reported occurrence of heterospory of the pteridophytic type in *Noeggerathiostrobus bohemicus*. Some new information was gained, chiefly on the number of megaspores in the sporangium, and on a few morphological details; for the rest my studies have in most respects confirmed Dr. Němejc's observations — but not his conclusions regarding the taxonomic relations of the *Noeggerathiineae* to other groups.

For several reasons it appears desirable that the present opportunity be used to discuss on broad lines the interpretation of some interesting morphological features and its taxonomical consequences. These matters have been extensively dealt with by Professor Hirmer in the important contributions (1940, 1941) mentioned at the beginning of this article. He has arrived at very definite and interesting conclusions, but I venture to think that the questions under discussion ought not to be considered settled quite so definitely as he believes.

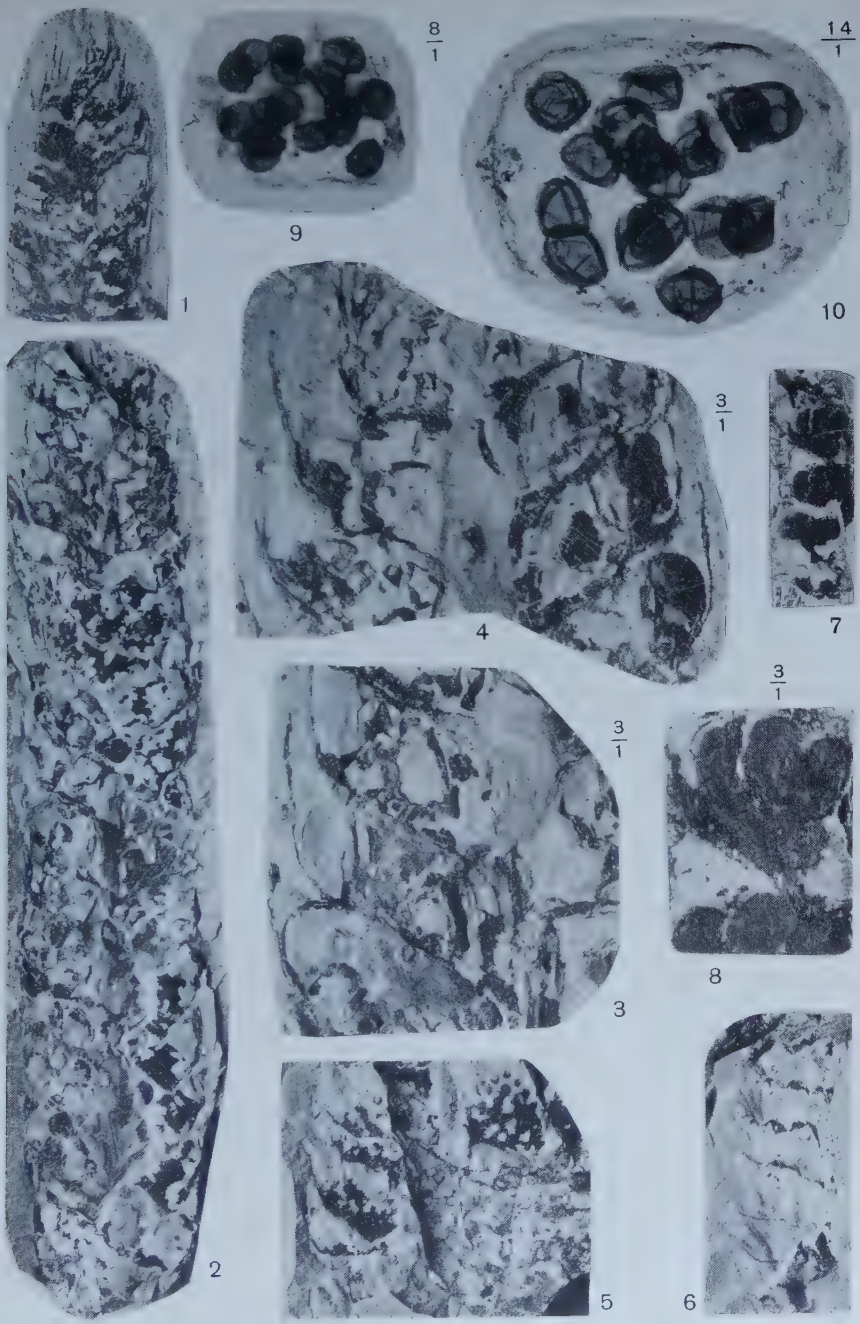
Hirmer very positively asserts that *Noeggerathia* is a fern frond and *Noeggerathiostrobus* the corresponding sporophyll.[1] His morphological interpretation of the cones is primarily based on the features of the sterile fronds. The reasoning is most conveniently explained by reference to Stur's drawing (our text-fig. 1, *a*). This figure is, quite naturally, assumed to show the upper side of the frond, which is no doubt correct at least as far as actual orientation in relation to space is meant (provided that the frond was more or less plagiotropic); but the orientation in relation to the parent shoot cannot be directly established, since the latter is unknown. However, as the leaflets are inserted obliquely, each slightly overlapping the next higher one on the same flank, Hirmer concludes that they turn their morphological undersides towards the rachis. If the leaflets are con-

[1] The discussion is attended with practical difficulties because one and the same organ or part of the plant is in some important cases placed in different morphological categories by different authors. I have used the comparatively non-committal terms "cone" and "cone-scale" for the fertile specimens, but shall speak of the sterile specimens as "fronds" (with "leaflets"), though I am not quite convinced that this term correctly expresses their nature.

sidered by themselves — with reference only to the axis on which they are inserted — it would be more natural to regard the side facing the next higher leaflet, and consequently the rachis, as the adaxial side; if the leaflets were leaves borne by the axis of a shoot, as believed by several authors (e.g., SEWARD, 1910), this view would be the obvious one.

HIRMER's discussion of the morphology of the cone is based on the features of the sterile frond as interpreted by him. "Der ... *Noeggerathia*-Wedel wird in seinem oberen Teil dadurch zur Fruktifikation umgebildet, dass die am sterilen Wedel noch schräg quer sitzenden Fiedern nun völlig quer zur Rachis inseriert werden und an der der Rachis zugekehrten Seite flächenständig die Sporangien tragen ..." (1940, p. 5). This reasoning led to the conclusion that the actually upper (adaxial) and sporangium-bearing sides of the cone-scales (fertile pinnae) represent the morphological underside of the sporophyll. The conclusion is particularly important because the position of the sporangia thus ingeniously *deduced* forms one of the chief arguments for classing *Noeggerathia* (*Noeggerathiostrobus*) among the ferns. — The wording of the sentence quoted above almost seems to suggest old ideas of metamorphism, whereas it is naturally only a figure of speech expressing an undeniably concise and instructive comparison. The fact remains that the morphology of the reproductive organs is explained by reference to the features of the sterile frond. However, experience from morphological research on a phylogenetic basis, especially well-known studies of fossil pteridophytes, has shown how misleading it can be to explain the morphology of reproductive organs by theoretical deduction from features of the vegetative parts.

It is of great interest in this connexion to consider the very remarkable "organ genera" *Discinites* K. FEISTM. and *Saarodiscites* HIRMER. These are included by HIRMER in the *Noeggerathiineae* on evidence which appears very convincing, and are interpreted, on much more doubtful grounds, as sporophylls. *Discinites* is stated most probably to belong together with sterile fronds referred to *Palaeopteridium* KIDST.; in the case of *Saarodiscites* the connexion with fronds referred to the genus *Saaropteris* HIRMER is held to be established beyond doubt. Both *Discinites* and *Saarodiscites* could aptly be described as typical massive cones, the more so since they seem to have had a radial symmetry; they are undeniably more cone-like than *Noeggerathiostrobus*. The corresponding sterile fronds, on the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other hand, are much more fern-like than *Noeggerathia foliosa*, being more compound, in *Saaropteris* at least bipinnate. No one, surely, would think of explaining the morphology of these cones chiefly by reference to the features of the corresponding sterile fronds; HIRMER does not do so, but builds on comparison with *Noeggerathiostrobus*. — These remarks are only intended to show that the *method* of morphological derivation discussed above would completely break down if it were applied to the these four genera. But it must be admitted that I find it very hard to look on the cone-like specimens of *Discinites* and *Saarodiscites* as fertile fern fronds.

(As I have not carefully studied the relevant literature, including reviews, nor seen specimens of these four genera, no passages or illustrations in the literature are cited here; the reader is referred to the interesting and important publications by Professor HIRMER and the papers and other contributions by Dr. P. GUTHÖRL mentioned there.)

HIRMER has made out a fairly strong case for interpreting *Noeggerathia foliosa* as a fern leaf, even though the argumentation is largely indirect (comparisons *via Noeggerathiostrobus* — *Discinites* and *Saarodiscites* — *Palaeopteridium* and *Saaropteris*). But the opposite view, that these specimens are leafbearing shoots, has not been directly disproved. An obvious argument in favour of a foliar nature is the distichous arrangement of the leaflets. A similar phyllotaxis is not quite unknown in the *Pteropsida*; among undoubted ferns it occurs in the very different *Psaronii distichi* (see HIRMER, 1927, pp. 547 ff.). The petrified stems of *Protopitys* GOEPP. have distichous leaf-traces, but their leaves are unknown. They possessed secondary growth and have been compared to pteridosperms. There is no evidence whatever of relation to *Noeggerathiae*, and the geological age of the known species is different. But it may be of interest to note the existence of a little known group combining distichous phyllotaxis with some filicinean features: it has been said of *Protopitys* that "it is in some ways Fern-like, but is not a Fern" (SCOTT 1923, p. 155).

Even if the known sterile specimens of *Noeggerathia foliosa* were regarded as deciduous branches of limited growth, this view need not seriously clash with the undoubted foliar nature of *Palaeopteris* and *Saaropteris*. The "leaflets" of the former species would then be entire leaves; but the difference between them and the compound fronds of the two other genera would be no greater than the variety occurring among typical ferns.

Yet another view may deserve to be considered. The current opinion is that the specimens of *Noeggerathia* and *Noeggerathiostrobus* belong to the same morphological category: that either both are leaves or both shoots. However, the evidence is not conclusive. It is founded chiefly on the similarity of the "leaflets" at the cone basis to those of the supposed sterile frond. As a possible argument against the prevailing view it may suffice to quote only one instance among several, namely a certain feature of *Williamsonia gigas* Carr. This bennettitalean fructification is undoubtedly a strobilus (or even a compound inflorescence). At its base it bears simple entire bracts, which it is quite natural to compare to the pinnae of the corresponding sterile compound fronds, known as *Zamites gigas*. The present case may well be somewhat similar, though no taxonomic relationship exists: *Noeggerathiostrobus* may be a shoot even though *Noeggerathia foliosa* is a compound frond. If this were so — which is of course only suggested as a possibility — several difficulties connected with the present problem would be removed.

Concerning questions of nomenclature it need only be noted that Hirmer discarded the genus *Noeggerathiostrobus* in consequence of the specific identification of *N. bohemicus* and *Noeggerathia foliosa*. This is in agreement with the rules in force at that time, but not with paleobotanical practice, which tends to keep the so-called "organ genera" separate in similar cases. *Noeggerathia* cannot with any certainty be characterized as a natural genus in the ordinary taxonomic sense; it is very possible that not all species referred to it are really congeneric. By introducing the possession of a fructification of *Noeggerathiostrobus*-type in the diagnosis of *Noeggerathia* this character might easily be attributed to forms whose unknown reproductive organs may be of a different type.

The taxonomic position of the *Noeggerathiineae* depends on the morphological interpretations discussed above. Hirmer has adduced extensive evidence in favour of classing these plants among the typical *Filicales*. But at present it would seem better not to take a definite stand in this matter — nor in regard to the morphological interpretations. The natural tendency to squeeze fossil forms into existing taxonomical groups has too often led to unfortunate consequences. In the present case it would seem a safer course — whatever headlines be adopted for practical purposes — to regard the *Noeggerathiineae* as an isolated group of *pteridophyta incertae sedis*.

I am indebted to Professor O. H. Selling for working facilities at the Paleobotanical Department of the Swedish Museum of Natural History, and to Mr. K. E. Samuelsson of that institute for skilful and valuable technical assistance.

Naturhistoriska Riksmuseum, Stockholm 50, May 1954.

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Explanation of Plate I.

Noeggerathiostrobus bohemicus O. Feistm.

Figs. 1, 2. Impressions of cones; nat. size.
Fig. 3. Part of fig. 2, showing sporangia and upper parts of sporangium-bearing scales (accidentally broken and seen in profile); × 3.
Fig. 4. Detail from another cone, showing scales and sporangia: × 3.
Figs. 5, 6. Impressions of fragmentary cone-scales in surface view; fig. 6 showing marginal teeth; nat. size.
Fig. 7. Three groups of sporangia; nat. size.
Fig. 8. Part of fig. 7; × 3.
Figs. 9, 10. Two megasporangia after maceration, showing remains of the sporangium-walls and in each sporangium 16 megaspores; fig. 9, × 8; fig. 10, × 14.

All figures from the author's old negatives, which have been skilfully printed, but not retouched, by Mr. K. E. Samuelsson. — Specimens shown in figs. 1—7 are presumably kept in the museum of the geological survey in Vienna; the preparations, figs. 9 and 10, were returned to Dr. F. Němejc, Prague. — All negatives are kept in the Paleobotanical Department of the Riksmuseum, Stockholm.

Svensk Botanisk Tidskrift. Bd 48, H. 2. 1954.

CONTRIBUTIONS TO THE GEOLOGICAL HISTORY OF THE HEPATICAE.

FOSSIL MARCHANTIALES FROM THE RHAETIC-LIASSIC COAL-MINES OF SKROMBERGA (PROV. OF SCANIA), SWEDEN.

BY

BRITTA LUNDBLAD.

Introduction.

To the palaeontologist it is obvious that, owing to the small size and the delicate nature of their plant bodies, the *Hepaticae* — with the possible exception of their spores — must generally be poorly represented in fossil records. More forms are naturally known from Tertiary than from Palaeozoic and Mesozoic deposits, not least because of the unique source of Liverwort remains afforded by the amber on the shores of the Baltic. In the scarce records from Mesozoic and Palaeozoic strata there is but one case showing fertile structures, and the affinities of the sterile remains referred to this group are generally rather doubtful unless the cell structure of both the thallus and the rhizoids is known. This is the case in five species from the Mesozoic (including the above-mentioned fertile form); there are four satisfactory Palaeozoic species (cf. Harris 1939, p. 70; 1942). A considerable number of forms, which with a ± high degree of probability represent remains of Liverworts (see p. 405 *et seq.*), have in addition been described in literature.

The four species of sterile shoots of Hepatics from the Palaeozoic described by Walton (1925, 1928; cf. p. 405) indicate that there existed, as early as in the Upper Carboniferous, forms similar in habit to some of the more advanced living genera of the *Anacrogynae* [the fossils have been compared with *Metzgeria*, *Riccardia* (*Aneura*), *Treubia*, and *Fossombronia*]. Another find described by

the same author (Walton 1949) may possibly indicate that *Riccia*-like forms existed at the same time, a fact that does not seem so very unlikely in the light of the material from the older Mesozoic presented below.[1]

The only fertile Mesozoic form, *Naiadita lanceolata*, is thoroughly known from recent investigations by Harris (1938, 1939), which proved the Liverwort affinities of the plant. Its leafy shoots were discovered more than a century ago, and have in the course of time been ascribed to different taxonomic groups. The material at Harris's disposal was extremely abundant, and by the aid of transfer preparations, and particularly by surface dissection under the microscope of the fossils in xylol or paraffin oil, he succeeded in distinguishing the cellular details of the gametophyte — including archegonia and gemmae — as well as important features of the sporophyte, e.g. the structure of the capsule and the spores. Although habitually resembling a Moss, *Naiadita* was shown to agree in most features with the Liverworts, and was tentatively compared with the living genus *Riella* of the *Sphaerocarpales*; Harris considered it a primitive type.

According to the bryologist Fulford (1951, p. 246) the sporophyte of *Naiadita* was "as much specialized as are some specialized living forms", which she comments by saying that "at least certain structures of hepatics have changed very little in the long time from the Upper Carboniferous or Triassic to the present".

In the publication just quoted, Fulford drew attention to the light shed on the past history of the Liverworts by the distribution patterns of selected groups of living *Hepaticae*. Of particular interest are groups of genera occurring in South America and other lands of the Southern Hemisphere or in Nepal-Sikkim. As pointed out by Fulford (1951, pp. 256—259), we have here an interesting parallel to the distribution patterns shown by Florin (1940) for the sections *Eutacta* and *Colymbia* of the genus *Araucaria* and the sections *Dacrycarpus* and *Polypodiopsis* of the genus *Podocarpus*. *Eutacta* and *Colymbia* are represented in the Jurassic; *Dacrydium*, too, probably appeared in the Mesozoic. The Jurassic has been supposed to be the latest possible time when the wide land connections in the Southern Hemis-

[1] Attention should be drawn to the fact that thalloid plants, in their general organization comparable with lower Bryophytes, existed in Pre-Carboniferous time. *Protosalvinia* (Upper Devonian) seems to have the same life-form as certain Riccias. Its position in the Plant Kingdom is discussed by Ch. A. Arnold in this issue of Svensk Botanisk Tidskrift (p. 292).

phere still existed. The distribution of the groups studied by Fulford, might then constitute evidence of several phyletic lines' of leafy Hepatics having been in existence in the Older Mesozoic. This would apply to the *Lejeuneaceae* line — already segregated into sub-groups and various living genera — the *Frullaniaceae*, and some phyletic lines included in the primitive families *Ptilidiaceae* and *Lepidoziaceae* (see Fulford op. cit., p. 262).

Contributions to our knowledge of the geological history of the Liverworts may possibly be expected from yet another source, viz. from a study of spores. This subject was approached by E. M. Knox in connection with her work on microspores of the Carboniferous. To facilitate comparison, Knox made a special study of the spores of living Mosses and Liverworts; she has drawn attention to the fact that some of the recent *Bryophyta*, particularly the *Hepaticae*, have spores which in shape and sculpture strikingly resemble some of the microspores of the Carboniferous. From an analysis of spores from the Productive Coal Measures of Great Britain Knox (1949, p. 118) ventures the assumption that "many of the spore types are probably of pteridospermic affinity, but the majority might be expected to be of Pteridophytic and Bryophytic origin". (For further references to papers by Knox, see pp. 400—401.)

Although only including very few certain records of megascopic fossil remains, the evidence collected from various sources indicates that the major groups of Hepatics were differentiated in the Palaeozoic, and that representatives of living families — in cases even modern genera — might be expected in Mesozoic floras.

The fossil records of the *Musci* are even less satisfactory than those of the *Hepaticae*. There is, however, evidence that the group has existed at least since the Carboniferous, and that Mosses and Liverworts have existed as distinct lines since that time (see for instance Dixon 1927, and Arnold 1947).

Two species from the Late Carboniferous (Stephanian) of France are of interest, viz. *Muscites polytrichaceus* Renault & Zeiller, and *M. Bertrandi* Lignier. The former, which is supposed to represent an Acrocarpous Moss, shows a tuft of sterile shoots, and is preserved as a compression. The latter, from the famous silicified rock of Grand-Croix, near Saint-Étienne, is a partial transverse section of a Moss stem.

Arnold (op. cit., p.59) says that "fossil mosses in the Mesozoic rocks are almost nonexistent". A couple of records of supposed *Sphagna* are of interest, if reliable, particularly one of a leaf in material of Jurassic age from Nuremberg (Lias α, Altdorf), which is figured as "*Sphagnum* sp." in a recent publication by Reissinger (1950, pp. 102—103; Pl. 11, Fig. 12); a supposed

"*Sphagnum* Spore" is described in the same connection (op. cit., Pl. 12, Fig. 13).

Remains of Mosses are, like those of Liverworts, more common in Tertiary floras; a number of forms from the amber have been referred to living genera. Of special interest is further the well-preserved material from the Miocene shales of Lake Florissant, Colorado, which includes three capsule-bearing forms (see STEERE 1946).

Before ending this introductory review, I should like to point to a fact which may easily escape the attention of palaeontologists. Although often generally spoken of as "Hygrophytes", the *Hepaticae* include a number of xeromorphous types of considerable interest. Such forms are perhaps particularly known from the *Marchantiales* (see GOEBEL 1930, pp. 781 *et seq.*). The genus *Riccia*, for instance, is represented in most of the arid regions of America, Eurasia, Africa, and Australia (cf. GAMS 1932, p. 351). Since xerophytes have generally a more strongly cutinized epidermis than Hygrophytes and Mesophytes, they may be more suitable for preservation in a fossil state.[1]

At the end of the Palaeozoic and the beginning of the Mesozoic large areas of the earth's surface became deserts, and the luxuriant vegetation of the Carboniferous was succeeded by floras containing components of ± xeromorphic character. Members of the lines of Hepatics existing in the Permian and the Triassic must also have had to adapt themselves to life under dry conditions. Forms that might be interpreted as "climatic relics" (WULFF 1943, p. 79) should therefore *prima facie* be looked for in the floras of the Upper Triassic and Lower Jurassic, which correspond to a change towards more humid climatic conditions. Hepatics are particularly suitable for survival as "climatic relics", because they occupy microhabitats, and may be subjected to a climate (microclimate) that may differ considerably from the general climate of the region (cf. FULFORD 1951, p. 246).

The Material.

While studying material of the genus *Podozamites* BRAUN from various localities in the Rhaetic-Liassic of Scania, the author dis-

[1] Fragments of a xeromorphic *Riccia* (*R. limbata*, Cape Province, Lions Head, leg. SIGFRID ARNELL 29.8. 1951) were submitted to treatment with concentrated Nitric Acid and Potassium Chlorate, followed by Ammonia, i.e. the ordinary "maceration" procedure used for fossil leaf cuticles. The epidermis was able to stand the oxydative treatment during considerable time (at least half an hour for the marginal portions of the segments).

covered the small dichotomizing thallus shown in Pl. III: 1. Recognizing its resemblance to the Liverworts, she showed the fossil to Prof. T. G. Halle and Dr. H. Persson, who both suggested a comparison with the living genus *Riccia*. The material was preserved in a light-grey clay from the roof of the upper coal bed at Skromberga, and is exposed on the rock specimen which shows one of the shoots figured by Johansson (1922, Pl. 6, Fig. 28) under the name of *Podozamites lanceolatus* (Lindl. and Hutton) Schimp. Johansson has apparently overlooked the insignificant structure, as he does not list any Bryophytes in his account of the flora of Skromberga (op. cit.). My find led to all the rock specimens' collected in the same horizon being examined, magnified under xylol, and the "flower"-like structures seen in Pl. I: 1, were then also recognized as representing thalli of Liverworts. Curiously enough, Johansson did not figure these rather characteristic structures in his paper. The specimen is, however, labelled in his handwriting: "Problematicum Skromberga övre." Some even more inconspicuous remains of thalli were also discovered in material from the same locality. The best specimen is shown in Pl. III: 6.

Pieces of a couple of rock-specimens from Skromberga showing megascopic remains of Hepatics were treated with hydrofluoric acid of varying concentrations (20—40 %; mostly several weeks in ± dilute acid); rather large quantities of fragments showing cellular structure were obtained in this way. The material, part of which is shown in Pl. III: 9—11, and in Pl. IV: 1—6, proved to be of particular interest in view of the presence of air-pores of Marchantialean type in many of the fragments.

Attempts were also made to isolate spores from the rock samples containing the thalli shown in Pl. I: 1 and in Pl. III: 1. An interesting spore type widely distributed in the Scanian Rhaetic was recognized as probably representing the spore of a *Riccia*-like form; material of this kind is shown in Pl. IV: 8—12.

Nomenclature.

Two form-genera are in current use in the naming of fossil Hepatics, viz. *Thallites* Walton and *Hepaticites* Walton (1925). *Thallites* was defined by its author as follows (op. cit., p. 564):

"Fossils in which the plant body is of a thalloid form, as may be found in the Algae, Bryophyta, or sometimes in higher groups;

but possessing no characters by which they may be assigned to any one of these groups to the exclusion of all the others."

Hepaticites was defined in the following way (op. cit., p. 565):

"Fossil plants bearing evidence of a relationship to the living Hepaticae, and also exhibiting characters by which they may be distinguished from the Algae, Pteridophyta, and other divisions of the Plant Kingdom, are to be assigned to the form-genus *Hepaticites*, if the knowledge of their structure is too incomplete to warrant the use of a distinctive generic term."

In practice, the character used for referring a thalloid plant to *Hepaticites* rather than to *Thallites* is usually the rhizoids (cf. HARRIS 1942, pp. 393—394).

Before WALTON's revision of the nomenclature of fossil Hepatics, the generic name *Marchantites* was widely applied to fossil remains resembling Liverworts. It was originally used by BRONGNIART (1849, p. 61) for the well-preserved, fertile remains of *Marchantites sezannensis* from the Eocene of the Paris basin (p. 411). SEWARD (1898, p. 233) defines it as follows in his handbook "Fossil Plants": "Vegetative body of laminar form, with apparently dichotomous branches, and agreeing in habit with the recent thalloid Hepaticae, as represented by such a genus as *Marchantia*." As pointed out by WALTON (1925, p. 563), the application of the term *Marchantites* to thalloid plants of admittedly unknown affinities has led to considerable misunderstandings; this was the main reason why he suggested the use of *Thallites*, of which he wrote (p. 564):

"This form-name is applicable to all fossils which up till now have been named *Marchantites*, except those such as *M. Sezannensis* Sap., which bear undoubted affinities to the Marchantiaceae."

In his paper on the "Cenozoic and Mesozoic Bryophytes of North America", STEERE (1946, p. 304) discusses several members of the genus "*Marchantites* Brongniart emend. Walton", which he comments as follows: "Fossil Hepaticae with the characters of the order Marchantiales are to be assigned to this form-genus."

In VERDOORN's chapter on the "Classification of Hepatics" in "Manual of Bryology" (1932) the order *Marchantiales* is divided into six families comprising among others the *Marchantiaceae* and the *Ricciaceae; Sphaerocarpales*, with two families, forms an order of its own. EVANS (1939) has a similar arrangement. In the last edition of RABENHORST's Kryptogamenflora, however, MÜLLER (1951, pp. 195—196) divides the order *Marchantiales* into three sub-orders,

Sphaerocarpineae, *Marchantiineae*, and *Ricciineae;* the number of families in the two last is considerably larger than in the Marchantialean families in the first-mentioned publications. The *Ricciineae* comprises two families, *Oxymitraceae* and *Ricciaceae*, of which the latter contains two genera, *Ricciocarpus* and *Riccia*.

For material as closely resembling *Riccia* in habit as our two main specimens from Skromberga, the designation *Marchantites* would be inadequate and misleading. I propose to introduce a new generic name, *Ricciopsis*, for similar forms. The type species of the genus is *Ricciopsis Florinii* n. sp. (see below). The diagnosis of *Ricciopsis* would be as follows:

Sterile fossil thalli of Hepatics showing closer resemblance to the Ricciineae than to any other living group.

Most of the thallus fragments with preserved cellular structure obtained by treating rock material from Skromberga with hydrofluoric acid show air-pores resembling the more complicated pores of the sub-order *Marchantiineae* rather than the very simple pores mostly seen in *Riccia*. For material of this kind I suggest a new genus, *Marchantiolites*, the diagnosis of which is given below:

Sterile fossil thalli of Hepatics, the preserved cellular structure of which shows air-pores resembling those characterizing the sub-ordo Marchantiineae of the Marchantiales.

The type species of *Marchantiolites* is *Marchantiolites porosus* n. sp. (p. 393).

The position of the new genera is discussed on pp. 403—405.

Description of the Sterile Remains of Thalli.

Genus ***Ricciopsis*** nov. gen.

Diagnosis. — See above.

Ricciopsis Florinii n. sp.

Pl. I: 1—4; Pl. II; Fig. 1 A.

Type material: the rock specimen shown in Pl. I: 1. The thallus seen in the lower half of Pl. I: 3 (to the right in Pl. I: 1; part of the specimen is magnified in Pl. I: 4) is regarded as the holotype of the species. The information on the structure of the rhizoids and epidermis was obtained from the study of a balsam transfer of the indistinct thallus seen to the left in Pl. I: 1, which is accordingly regarded as a paratype.

Coll. — Name of collector unknown.

Occurrence. — Skromberga, in roof of upper coal bed.

Age. — Liassic.

Diagnosis. — Plant thalloid. Thalli occurring singly or in groups, of more or less circular shape, forming rosettes of crowded segments; diameter of single specimen about 2.5 cm. Thallus branched dichotomously, margins of segments slightly uneven. Shape of apex of lobes probably ± roundish; widths of ultimate portions of segments 1—3 mm. Segments showing distinct median channels from centre of thallus to marginal lobes; channels about 0.5 mm wide, dichotomizing about three times. Pl. I: 1—4.

No ventral scales observed. Epidermal cells of the fragments examined polygonal, thick-walled, up to 80 μ wide. Pl. II: 7—8.

Rhizoids 1—2 mm long, about 23 μ wide (range 12—36 μ; ten measurements), attached to ventral portion of thallus, tuberculate or smooth-walled, unicellular or multicellular, with oblique transversal walls, and occasionally ramified. Pl. II: 1—6.

Remarks. — The type material on which the diagnosis was based is shown in Pl. I: 1; a reconstruction of *Ricciopsis Florinii* is given in Fig. 1 A. Unfortunately, the thalli were too strongly carbonized to allow much information about their structure to be gained by direct observation with or without immersion in xylol or paraffin oil.[1] A balsam transfer was made from the indistinct specimen to the left in Pl. I: 1. This shows, on the ventral surface of the thallus, rhizoids (Pl. II: 1—2) which are strongly developed particularly in the marginal portions of the segments. The distribution of the rhizoids probably corresponds to the original condition; it should, however, be borne in mind that structures of this kind may easily get lost during preparation. It appears that there are both smooth-walled and tuberculate rhizoids present, but the interpretation of the latter, which are characteristic of the *Marchantiineae* and the *Ricciineae*, is difficult in fossil material. The presence of cell-walls in the rhizoids[2], which can be seen in Pl. II: 5, is of interest as suggest-

[1] Photographs of the thalli were also taken in infra-red light—it was thought that the presence of sporogones in the thallus might possibly be revealed in this way—but these did not add to our knowledge of the material.

[2] Dr. ARNELL has suggested to me the possibility that (multicellular) rhizoids from other plants might have become entangled with those of the *Ricciopsis* specimen. This is an important remark, but since rhizoids with transversal walls have been observed among those attached to the thallus fragment shown in Pl. II: 3 there is little doubt that the multicellular rhizoids belong to the thallus itself.

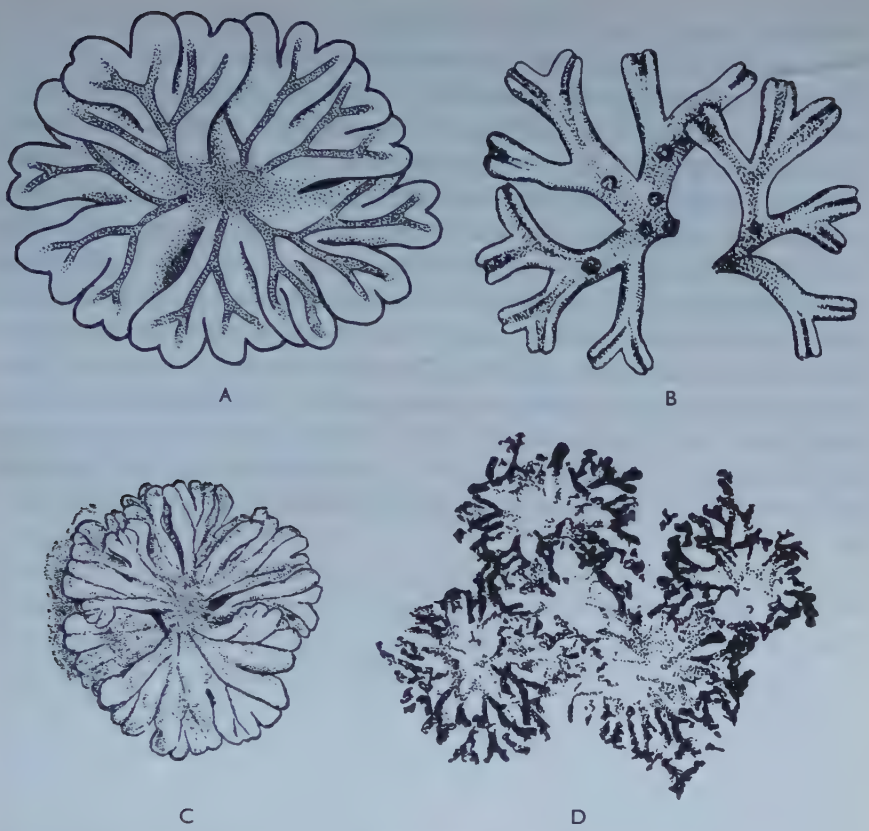

Fig. 1. A, *Ricciopsis Florinii* n. sp. Skromberga, Liassic. Attempt at a reconstruction of the thallus. The drawing is based on one of the specimens in Pl. I: 2. (Shape of apices uncertain.) 2/1. — B, *Riccia Warnstorfii* Limpr. in Warnstf. Thalli, showing median furrows in the segments. 5/1. From Müller (1952, p. 456). — C, *Ricciocarpus natans* (L.) Corda. Terrestrial form. 2/1. From Campbell (1918, p. 40). — D, cf. *Hepaticites* sp. Four thalli on the surface of a piece of shale. Dollar, Clackmannanshire, Upper Carboniferous. 1/1. From Walton (1949, p. 279).

ing a resemblance to the *Musci*; multicellular rhizoids are also known, however, from the genus *Schistochila* of the *Hepaticae* (see Goebel 1930, p. 740). — A couple of small fragments showing outlines of thick-walled, polygonal cells could be removed from the transfer preparation, and studied under higher magnification; they are shown in Pl. II: 7—8. — Ventral scales have not been observed in the specimens studied, but in the *Ricciaceae* these structures are often destroyed early (cf., for instance, Müller 1952, p. 413); they may also have been lost during fossilization.

No structures distinguished in the thalli studied by us could be

identified with certainty as representing reproductive organs. The extrusion in the basal area of the thallus portion seen in Pl. I: 4 might possibly have something to do with sexual — or rather vegetative — reproduction, but probably represents a body of entirely unknown origin lying on the surface of the thallus. The structure was dissolved by oxidative treatment. In modern Riccias, the spore capsules are embedded in the thallus, and the spores are thick-walled and remarkably resistant. Fragmentary portions of the fossil thalli studied by us were treated with Nitric Acid of varying concentrations, followed by Ammonia, but none of our attempts to obtain spores were successful. It should be remembered, however, that the family *Ricciaceae* contains some species that are rarely fertile, and others that are unknown in the fertile state. Sporogones are, for instance, very rarely found in *Ricciocarpus natans* and only in the land-form of *Riccia duplex*, while *Riccia fluitans* is only known as sterile.

Comparison. — That there are close affinities between *Ricciopsis Florinii* and modern Riccias can in my opinion hardly be denied. The very characteristic median channels or furrows in the segments of several members of the *Ricciaceae* (cf., for instance, the thalli of the genus *Riccia* itself shown in Figs. 115—118 of Müller 1952) are very prominent in our species. A specimen of *Ricciocarpus natans* (L.) Corda, of which I have had the opportunity to study living material, is shown in Pl. I: 5, for comparison in this respect. In Fig. 1 a reconstruction of *Ricciopsis Florinii* is compared with two living members of the *Ricciaceae*, and an interesting thalloid plant from the Carboniferous (see pp. 405—406), which may possibly represent a similar form, is also depicted there.

I wish to point out that *Hepaticites solenotus* Harris (p. 407), a species from the *Naiadita* bed of the British Rhaetic, resembles *Ricciopsis Florinii* in having a deeply channelled thallus surface. The general habit of the species does not recall *Riccia*; its thallus is sparingly branched, with unicellular rhizoids. Harris regards the contour of the thallus surface in *Hepaticites solenotus* as a result of fossilization, but an explanation of this kind is not sufficient in our case. Multicellular rhizoids similar to those of *Ricciopsis Florinii* have been described by Harris (1938, p. 71) from the *Naiadita* bed. The comparison is of little value; as pointed out by Harris, many, or even most recent Mosses have rhizoids of this type.

The systematic positions of *Ricciopsis* and associated *Riccia*-like spores (p. 399 *et seq.*) are discussed on pp. 403—405.

Ricciopsis scanica n. sp.

Pl. III: 1—5; 6—8 (?); Fig. 2 (?).

The thallus shown in Pl. I: 1—3, is regarded as the holotype of a new species, *Ricciopsis scanica*. Beside this main specimen, however, a few additional Liverwort fragments of rather similar habit were found in the piece of rock containing *Podozamites* mentioned on p. 385. The cellular structure of the thallus, which could not be distinguished in the almost complete specimen chosen as the holotype, is visible in these (the best is shown in Pl. III: 6—8). These more fragmentary remains probably represent individuals within the range of the variation of the species, but since the interconnection of the specimens may be somewhat doubtful, I prefer to refer to them under the designation "cf. *Ricciopsis scanica*".

Coll. — F. Nissen 1876.

Occurrence. — Skromberga, upper coal bed.

Age. — Liassic.

The Holotype.

Pl. III: 1—5.

Diagnosis. — Rosette-shaped sterile thallus, about 1 cm in diameter, apparently consisting of four main branches from the centre, which dichotomize twice, the ultimate segments attaining a width of about 1 mm. Margin of segments probably entire or slightly uneven, apex of lobes roundish or emarginate-bifurcate (corresponding to incomplete dichotomy). The segments are thinner marginally, and a kind of ribs or striae are present in the lamina, running obliquely to the margin of the segments. No ventral scales or rhizoids have been observed.

The Rest of the Material (cf. Ricciopsis scanica).

Pl. III: 6—8; Fig. 2.

Description. — The best specimen — a fragment of a thallus — is figured in Pl. III: 6; it shows segments dichotomizing twice. These are about 1.5 mm wide; the best preserved is 8—9 mm long from the central point of branching, its distal lobe is 5 mm long. The median portion is thickened, and a striation with ± arcuate ribs running obliquely to the margin can be recognized in the translucent areas of the thallus, the striae being about 0.2 mm apart. No ventral scales were noticed. Two layers of cells were observed in the fragment. The cells, which are distinctly outlined, are polygonal in shape, ± isodia-

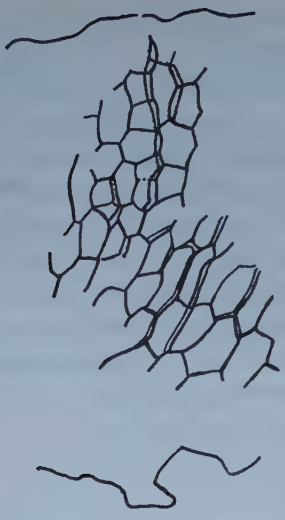

Fig. 2. Cf. *Ricciopsis scanica* n. sp. Skromberga, Liassic. Portion of thallus, showing two layers of cells. Drawing from transfer of Pl. III: 6, corresponding to the segment shown in Pl. III: 8. 100/1.

metric towards their margins, elongated in the interior regions of the segments. There are no well-defined rhizoids, but an indistinct structure slightly resembling an air-pore has been observed in the portion of the segment shown in Pl. III: 8.

Remarks.

The supposed specific identity of the holotype of *Ricciopsis scanica* n. sp. with the rest of the material mentioned above may need some comments. The thalli seen in Pl. III: 1—3, and in Pl. III: 6 are similar in general shape, but the latter obviously represents a larger specimen than the former. A feature common to the two specimens is the presence in the thallus substance of ribs directed ± obliquely towards the margin (Pl. III: 4—5, 7). The specimen seen in Pl. III:6, was made into a balsam transfer, in order to make the cellular structure of the thallus easier to observe. (The photographs, Pl. III: 6—8, were taken when the plant was still attached to the rock specimen, while the drawing in Fig. 2 was based on the transfer.)

Comparison.

Harris (1931, pp. 4—5; 1937, pp. 5—7; cf. p. 407 of this paper) has described four species of Liverworts from the Rhaetic-Liassic deposits of Scoresby Sound, East Greenland, but none of them bears any close resemblance to our material. *Hepaticites Rosenkrantzi* is

larger than *Ricciopsis scanica*, but resembles it in the dichotomous branching, which, however, occurs at irregular and often long intervals. There are two distinct layers of cells as in the specimen shown in our Pl. III: 6. *H. Rosenkrantzi* has characteristic round or oval cups on the surface of the thallus; this has not been observed in our material. *Hepaticites amauros* is said to differ from the other Greenland Liverworts "by its frequent dichotomy, narrow midrib and very thick substance" (HARRIS 1937, p. 7). It may possibly be comparable with our species in the first mentioned feature, but differs from it in the two latter characters. STEERE (1946, p. 302) says of *H. amauros* that "the apparent affinities are with members of the *Jungermanniales Anacrogynae*".

The material of *Thallites* described by KRYSHTOFOVICH & PRYNADA in 1933 from the Rhaetic-Liassic flora of the Cheliabinsk basin, Eastern Urals, is not closely comparable to our material (cf. p. 409).

Genus ***Marchantiolites*** nov. gen.

Diagnosis. — See p. 387.

Marchantiolites porosus n. sp.

Pl. III: 9—11; Pl. IV: 1—7; Fig. 3.

The material described in the following was obtained by treating rock material from the upper coal bed of Skromberga with hydrofluoric acid. It was preserved in the same piece of rock as the leaf of *Ginkgoites Hermelini* (HARTZ) HARRIS figured in JOHANSSON's paper (op. cit.) as Fig. 26, Pl. 6 ("*Ginkgoites* cf. *sibirica* HEER", p. 43).

The Holotype.

Pl. IV: 1; Fig. 3 A—C.

Coll. — Name of collector unknown.

Occurrence. — Skromberga, in roof of upper coal bed.

Age. — Liassic.

Diagnosis. — Fragment with preserved cellular structure representing the distalmost portion of a segment of a thalloid Hepatic. Apex obtuse, margin of segment ± uneven, width of segment about 2 mm or more (maximum length of the preserved fragment 2.6 mm). Pl. IV: 1.

The thallus consists of at least two cell layers; the one best observed has polygonal, ± isodiametric cells with a diameter of about 30—

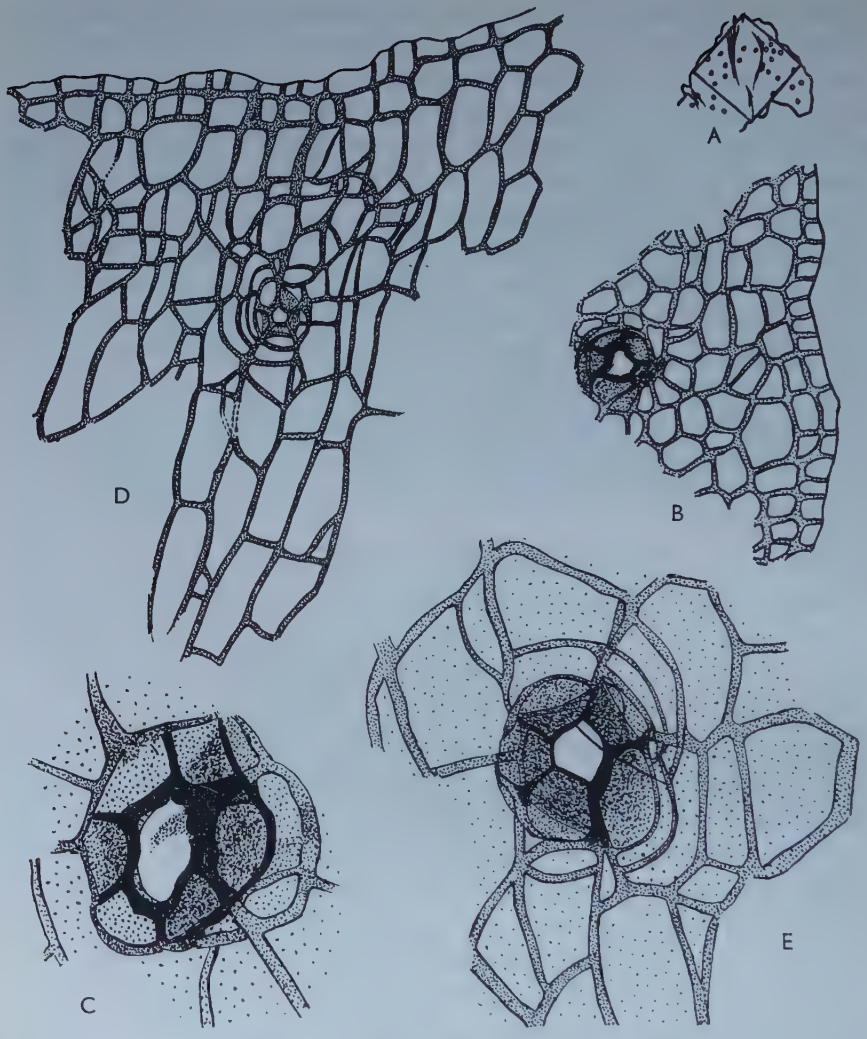

Fig. 3. *Marchantiolites porosus* n. sp. Skromberga, Liassic. — A, drawing of the specimen in Pl. IV: 1 (the holotype), showing distribution of air-pores. The square represents 1 mm². 10/1. — B, portion of thallus with air-pores (holotype). 200/1. — C, air-pore (holotype). 500/1. — D, portion of thallus with air-pore (cf. Pl. IV: 4). 200/1. — E, air-pore (cf. Pl. IV: 5). 500/1.

50 μ. At the margin there are 1—2 rows of smaller cells (about 20—30 μ in diameter). Fig. 3 B.

The epidermis is provided with air-pores apparently numbering about 19 per mm² in the distalmost portion of the lobe. They are

elevated, and each pore is surrounded by a concentric ring of 5—7 cells. These are of moderate size (about 10—30 μ in diameter) and of ± polygonal shape; the openings and radial walls are rather strongly cutinized. The diameter of the opening of the air-pore averages 24 μ (12—40 μ; ten observations). Pl. IV: 1; Fig. 3 A—C.

The Rest of the Material.

Pl. III: 9—11; Pl. IV: 1—7; Fig. 3 D—E.

Besides the type specimen, a considerable number of *Marchantiolites* fragments have been obtained, which, although more fragmentary, agree with the holotype in all essentials.

The specimen shown in Pl. III: 9, is of particular interest, as rhizoids are attached to one end of the fragmentary segment. These rhizoids are fragmentary (preserved portions up to 0.3 mm long), badly preserved, and approximately about 25 μ wide. No oblique walls have been observed in the incomplete portions available for study. There are air-pores similar to those of the holotype, and the epidermis is of the same structure. The preserved margin of the segment is slightly lobate.

The structure seen in some areas of their walls (Pl. IV: 7) may possibly indicate that the rhizoids are of the tuberculate type. (Corrosion of the wall by maceration may, however, possibly produce a similar appearance.)

The apex of the segment in Pl. III: 10 is nearly square. Somewhat indistinct ribs are indicated in its lateral portions. There are air-pores, and the epidermal structure is similar to that of the holotype.

The specimen in Pl. III: 11, which has air-pores and epidermal structure similar to the holotype, is figured to show the lateral ribs of the segment, which are 1—2 mm apart,

The fragmentary portion of a segment seen in Pl. IV: 2, shows somewhat stronger lobation than the holotype or the specimen figured as Pl. III: 9. The shape of the margin is, however, slightly distorted by folding.

A ventral scale may possibly be distinguishable in the fragment shown in Pl. IV: 3, but its nature is very doubtful.

Portions of a small thallus-fragment with unusually distinct air-pores are shown in Pl. IV: 4 –5; drawings of them are seen in Fig. 3, D—E. Pl. IV: 4, and Fig. 3 D clearly show the contrast between

the marginal rows of small cells and the large cells of the interior, and this is also seen in Pl. IV: 6.

Pl. IV: 6 shows two layers of cells in a thallus-fragment though the marginal row of small cells is simple.

Remarks.

I should like to point out that the holotype (Pl. IV: 1) may be interpreted as having a median furrow of the kind present in *Ricciopsis Florinii* and many living members of the *Ricciineae*. Since I am myself inclined to regard that structure as being due to mere folding, I have not mentioned its presence in the diagnosis (cf. p. 393).

Several of the fragments of *Marchantiolites* obtained by treating pieces of rock from Skromberga with hydrofluoric acid were afterwards submitted to short treatments with concentrated Nitric Acid and Potassium Chlorate for cleaning purposes. They could generally stand this treatment for some minutes without damage. This observation is of interest, as possibly suggesting a certain degree of xeromorphism (cf. p. 384).

Genus ***Thallites*** Walton.

See pp. 385—386.

Thallites sp.

Fig. 4.

The fragment from the Liassic of Skromberga shown in Fig. 4 was associated with *Marchantiolites porosus*, and is part of the material from the roof of the upper coal bed. There is accordingly every reason to assume that it, too, represents a portion of a Liverwort. Neither rhizoids nor air-pores have been observed, however. It might possibly have come from the same plant as *M. porosus*, but from a different part of it that had no air-pores. As there are no safe morphological criteria of its affinities to the *Hepaticae*, however, I have preferred to refer the material to the genus *Thallites*.

Description. — Fragmentary thallus segment with somewhat undulating margin, probably about 1 mm wide originally. Epidermal cells of varying shape: there are square cells at the margin and ± polygonal cells in the rest of the segment. The cells are isodiametric towards the margin, elongated in the interior. The walls of the epidermal cells are strongly cutinized; the underlying layer of cells was observed in places. The diameter of the small marginal cells is about 10—20 μ, while the larger cells may attain a length of up to 100 μ. Fig. 4 A—B.

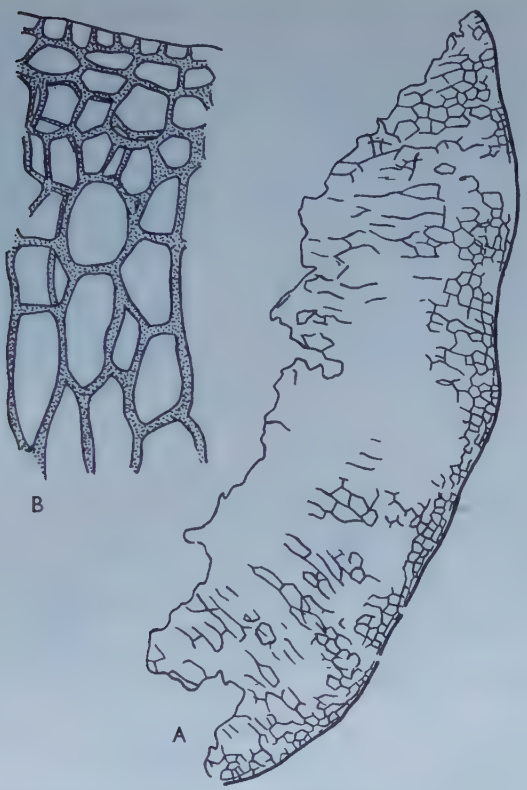

Fig. 4. *Thallites* sp. Skromberga, Liassic. — A, fragmentary segment. 50/1. — B, part of the lamina, enlarged. 200/1.

Comparison of Marchantiolites nov. gen. with the Living Marchantiinae.

The genus *Marchantiolites* is, by virtue of its type of air-pores, *ex definitione* compared with the sub-ordo *Marchantiineae* of the *Marchantiales* (p. 387). The following extract from the definition in MÜLLER 1951, p. 320, describes the vegetative characters of the gametophyte in this group: "Thallus dorsiventral, mehrzellschichtig, aus Grund- und Assimilationsgewebe aufgebaut, mit grossen Ölkörpern in vereinzelten, besonderen Zellen. Wachstum des Thallus erfolgt durch Scheitelzellen in den Thalluseinbuchtungen. Assimilationsgewebe mit Atemhöhlen und Atemöffnungen (Ausnahme *Dumortiera*). Atemhöhlen z.T. mit Assimilationsfäden oder angefüllt mit Zellplatten. Atemöffnungen einfach, vulkanförmig oder tonnenförmig. Thallusunterseite mit 2—4 Reihen Bauch-

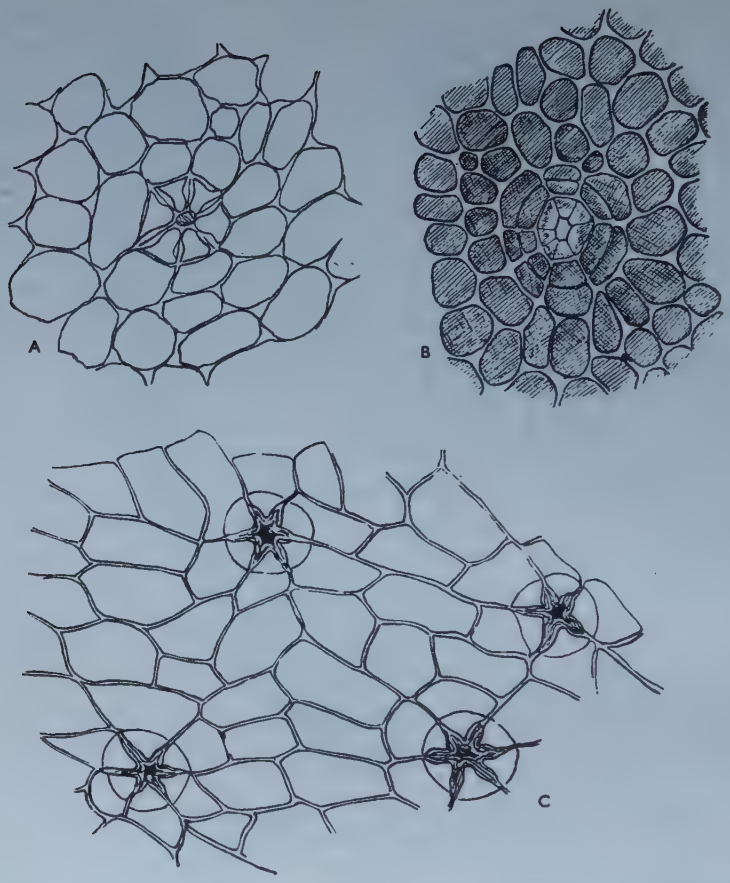

Fig. 5. Air-pores of living members of the *Marchantiales* (cf. fig. 3). — A, *Plagiochasma rupestre*. 280/1. From Herzog (1925, p. 55). — B, *Grimaldia* (*Mannia*) *fragrans*. 250/1. From Müller (1952, p. 339). — C, *Oxymitra* (*Tesselina*) *pyramidata*. 250/1. From Herzog (1925, p. 55).

schuppen (bei *Dumortiera* fehlen sie), mit glatten und Zäpfchenrhizoiden."

The well-developed assimilative tissue of the *Marchantiales* cannot be expected to be preserved in fossil material of the *compression*-type, in which the internal tissue between the upper and lower epidermis is generally destroyed. The thalli of the Scanian remains referred to *Marchantiolites* can therefore in any case hardly show more than two *well-preserved* layers of cells (Pl. IV: 6), whether the internal structure of the living thallus is highly differentiated or not.

The comparably simple air-pores of *Marchantiolites* do not resemble those of the living *Marchantiaceae*, which are compound (barrel-shaped). On the other hand they are not as highly simplified as in *Riccia* (cf., for instance, Herzog 1925, pp. 63—65), where the air-pores of most species are only narrow, enclosed air-spaces between the columns of cells of the chlorophyll-bearing layer. The nearest equivalents to the *Marchantiolites* type are found in the *Grimaldiaceae* (see Müller 1951, p. 329 *et seq.*), where both *Plagiochasma* and *Grimaldia* have similar air-pores. In *Plagiochasma* these are surrounded by only one ring, consisting of 4—6 cells; in *Grimaldia* there are 2—3 rings of 5—7 cells (see Fig. 5 A—B). In the other genera of the *Grimaldiaceae* — *Reboulia* and *Fimbriaria* — the pore is surrounded by a large number of cells (6—8), and they have respectively 4—5 and 2—5 rings.

It may be worth noting that the air-pores of *Oxymitra* (*Tesselina*), a genus which is of interest because its morphological features combine those of the *Ricciaceae* and the *Marchantiineae* (cf. p. 404), are rather reminiscent of the *Marchantiolites* air-pores, as may be seen from Fig. 5 C (cf. also Herzog 1925, pp. 54—55, and Müller 1952, pp. 410—412). In *Oxymitra*, however, their openings are stelliform.

The observations of presumed tuberculate rhizoids ("Zäpfchenrhizoiden") and ventral scales are noticeable, because structures of this kind are characteristic of the *Marchantiales*.

The presence of ribs in the lamina of some of the specimens of *Marchantiolites porosus* is not without interest. Harris (1942, p. 399), who observed similar structures in *Hepaticites Wonnacotti* from the Jurassic of Yorkshire (see p. 407) says that "Similar ribs are common in the Marchantiales, particularly in forms with strongly developed and persistent ventral scales which are attached along the ribs; and often, too, the ribs are supplemented by tuberculate rhizoids."

Description of Ricciisporites tuberculatus n. sp., a Spore Associated with the Swedish Material of Hepatics Described under Ricciopsis.

Tuberculate-reticulate spores united into tetrads are very common in the plant-bearing strata of the Scanian Rhaetic. The spore tetrads have for instance been found stuck to the cuticles of various plants; material from Hyllinge has been figured by the author on a previous occasion (Lundblad 1950, p. 75; Pl. 12, Fig. 3).

Samples of the rock-specimens containing *Ricciopsis Florinii* and *R. scanica* have been treated as suggested by A. S. Knox (1942; cf. Lundblad 1949 a) in order to separate the carbonaceous matter from the mineralic substance. The former was afterwards given the ordinary oxidative treatment with Nitric Acid and Potassium Chlorate, followed by alkali. A large number of spore tetrads were obtained from the rock containing *Ricciopsis Florinii*; no other spores were present in appreciable quantities. A few similar spore tetrads were also obtained after oxidative treatment of carbonaceous substance from the rock specimen with *R. scanica*; in addition, a broken tetrad was observed on the surface of one of the specimens described as *Marchantiolites porosus* (the holotype; not clearly distinguishable in the magnification used for Pl. IV: 1). The spore is termed *Ricciisporites tuberculatus*; the generic name refers to the resemblance of the material to a species of the genus *Riccia*, viz. *R. Curtisii* T. P. James, with which it shares the regular arrangement of the spores into tetrads. The specific name refers to the tuberculate surface of the spore.

Genus ***Ricciisporites*** nov. gen.

Diagnosis. — *Spores of roundish-tetrahedral shape, permanently united into tetrads. Distal surface strongly tuberculate, showing a reticulate perinium.*

Discussion. — The general characters of the spores of *Riccia* have been studied by E. M. Knox (1939), who examined the spores of Bryophyta with a view to comparing them with those of Carboniferous age. She describes the spores of the family *Ricciaceae* as follows (op. cit., p. 482):

"The tetrahedral spores of the *Ricciaceae* vary in size from 80 μ to 200 μ and, with few exceptions, are of the reticulate type as seen in *Riccia Beyrichiana* and *R. fluitans*. The alveolae are usually relatively small, so that a considerable number are seen across the spore diameter . . . The angles of the reticular meshes bear projecting papillae, and these may occur also in the few species where the regular network is replaced by a series of anastomosing ridges, some of which form irregular and incomplete alveolae as in *R. crystallina*. A distinctive character of all the spores of the *Ricciaceae* is the well-marked transparent and frequently crenulate border usually about 10 μ wide."

Fossil spores of *Riccia* will generally fall within the genera *Reticulati-sporites* (Ibrahim 1933, p. 33) or *Microreticulati-sporites*

E. M. Knox (1950, p. 319). The former genus was emended by Schopf, Wilson, and Bentall in 1946 (pp. 34—36). These authors and E. M. Knox (op. cit., pp. 319—324) give references to Palaeozoic spores of this kind. *Reticulati-sporites* forms are also known from the Mesozoic [see Weyland & Greifeld 1953, p. 41; Thiergart (1949) and Reissinger (1950) also give figures of reticulate spores], and from the Tertiary (cf. Thomson & Pflug 1953, p. 55, and others). A great many of these spores may, however, belong to the *Lycopodiineae*; reticulate spores are particularly common in the *Lycopodium clavatum* group, but are also known in *Selaginella*. E. M. Knox (op. cit., p. 335) states directly that in all probability "a large proportion of the fossil spores assigned to the genera *Microreticulati-sporites* and *Reticulati-sporites* are of Lycopodian affinity", but she points out later (p. 336), that "close parallels can also be drawn with spores of the Hepaticae", and says, that it is not unlikely that Bryophytic plants contributed their share to the formation of the coal swamps of the Carboniferous.

The genus *Ricciisporites* is separated from the said form-genera by a characteristic combination of a reticulate surface with strong tubercles in the spore wall, and by the spore's being always united into tetrads. Both the sculpture and the arrangement of the spores are reminiscent of *Riccia Curtisii* (and synsporous species of *Riccia*; see Duthie & Garside 1936, 1939). In the living species, however, the tubercles seen in our material (Pl. IV: 8, 12) are replaced by spines (Pl. IV: 13, 14).

Ricciisporites tuberculatus n. sp.

The Holotype.

Pl. IV: 8—9.

Coll. — Name of collector unknown.

Occurrence. — Skromberga, in roof of upper coal bed.

Age. — Liassic.

Diagnosis. — Spore tetrad with a diameter of about 108 μ, consisting of spores approximately 50 μ in diameter. The surface of the spore has very strong tubercles, about 6 μ wide (three measurements), and a reticulum with areolae about 5 μ wide (4—7 μ; three measurements). — Pl. IV: 8—9.

The Rest of the Material.

The rest of the Skromberga material agrees well with the type specimen in the general sculpture and habit of the spore.

The specimen shown in Pl. IV: 11 is photographed so as to show the reticulate perinium (perine). LEITGEB (1884), who studied the spores of *Sphaerocarpus terrestris*, which are joined into tetrads as in *Riccia Curtisii*, draws attention to the fact that the reticulum constituting the sculpture of its spores covers the tetrad completely. He therefore thinks that it cannot belong to the exine but that the sculpture of the perinium is reflected in this. According to LEITGEB, the sculpture of the *Riccia crystallina* and *R. glauca* spore[1] is of similar origin as that of *Sphaerocarpus*. *Ricciisporites tuberculatus* resembles *Sphaerocarpus* in that a reticulum covers the tetrads.

The presence of an equatorial border surrounding the spore may possibly be suggested in Pl. IV: 10.

Ricciisporites tuberculatus has been found in the following localities in Scania:

Skromberga, roof of upper coal bed	Basal Lias
Billesholm, upper coal bed	Rhaetic
Bjuv, lower coal bed	,,
Hyllinge, lower coal bed	,,
Höllviken, 1450—1485 m	,,

The dimensions of tetrad material from three of these localities are given below to show the range of variation of the species:

Locality	*Diameter of tetrads*
Skromberga	100 μ (76—124 μ)
Bjuv	106 μ (64—148 μ)
Höllviken	100 μ (84—128 μ)

Ten measurements were taken in each case; their ranges are given in brackets.

[1] Attention should be drawn to the fact that the structure of the spore wall in *Riccia* has been differently interpreted (cf., for instance, BEER 1906). In using the term perinium I follow HARRIS (1938, p. 45), who in describing the spores of *Naiadita lanceolata* (see p. 382, 407) used LEITGEB's terminology as given in GOEBEL (1930, p. 897). It appears as if *Ricciisporites tetradus* differs from *Riccia Curtisii* and other living Riccias by the presence of this covering, which may have been lost in the course of phylogeny.

The above diameters of Höllviken specimens refer to material from the 1480.78—1485.44 m level of the boring "Höllviken II". The species was very common there, and is associated with *Lepidopteris Ottonis* and *Pterophyllum compressum*, judging by the findings of cuticle fragments discussed in a previous connection (Lundblad 1949 b, p. 8; 1950, p. 56, 60). It was also observed at the 1451.81—1454.0 m level of the same boring.

Ricciisporites tuberculatus is a characteristic species widely distributed in Scania, and may probably prove a useful zone fossil in the Swedish Rhaetic-Liassic. It should be noted, however, that its vertical distribution has not yet been systematically studied; except for Skromberga, all the reports of the occurrence of the material refer to specimens occasionally observed in cuticle preparations. *R. tuberculatus* seems to have been very common in the Rhaetic. Its occurrence at Höllviken is particularly noteworthy from a stratigraphical point of view.

The Systematic Position of the Material.

It is of interest that the rather complete sterile thalli referred to the new genus *Ricciopsis*, the fragmentary segments with cellular structure and air-pores described as *Marchantiolites* nov. gen., and associated spores ascribed to the new form-genus *Ricciisporites*, all possess characters placing them in the order *Marchantiales*.

From a palaeobotanical point of view it is self-evident that the material designated *Ricciopsis Florinii* and *R. scanica* should be described as two different species. In the classification of fossil plant-remains, "it is a lesser evil to keep forms separated which are identical than to identify such as are distinct" (Halle 1913 a, p. 3). The considerable variation in the habit of the thallus that may be found in natural species of thallose Liverworts must not be forgotten, however. It may be due to different habitats and environmental conditions, as is for instance the case in *Riccia fluitans*, where the water-form is distinguished from the terrestrial form not only by the narrower and thinner segments of the aquatic plants, but also by qualitative characters, e.g. lack of rhizoids and ventral scales; *Ricciocarpus natans* (Pl. I: 5 and Fig. 1 C) is a similar form. In dioecious forms there may moreover be considerable differences in the sizes and shapes of the male and female thalli (see for instance *Riccia cupulifera*, Duthie & Garside 1936, Figs. 21, 31—32).

In interpreting the genus *Marchantiolites*, which is characterized by air-pores similar to those of the *Marchantiineae* it should be borne in mind that although in the majority of living Riccias the pores are simple, there may have been now extinct forms in which a *Riccia*-like thallus was combined with more elaborate air-pores. The segments of *Ricciopsis scanica* and *Marchantiolites porosus* are of the same dimensions, and it may be more than a haphazard coincidence that lateral ribs are visible in the lamina of both. Attention should be paid to the living family *Oxymitraceae*, in which features of the *Ricciaceae* are combined with features of the *Marchantiineae:* "Die Familie *Oxymitraceae* stimmt im Bau des Sporophyten mit den *Ricciaceae* überein, in Thallusbau und in der Chromosomenzahl gleicht sie dagegen den *Marchantiineae*" (Müller 1952, p. 410). It is of particular interest that *Oxymitra*, too, has air spaces and pores ("Atemöffnungen") of the type seen in the *Marchantiineae*.

Of particular interest is the rather close agreement between the spores described as *Ricciisporites tuberculatus* n. sp. and the living *Riccia Curtisii* T. P. James. Since the characteristic spores occur associated with *Ricciopsis Florinii* and *R. scanica* there are very strong reasons for believing that they belong to this genus.

The possibility must be considered, that *Ricciopsis* and *Ricciisporites* may correspond to one and the same natural genus. The tetrads of *Ricciisporites* seem to be exceptionally common in the Swedish Rhaetic, and it is then very near at hand to believe that they were obtained from dominating assemblages of one (or possibly a couple of synsporous) species of the *Ricciopsis* type. Considering the great distribution of *Ricciisporites* in the sediments of the Rhaetic of Scania, it is noticeable that only two rock-specimens showing complete thalli of *Ricciopsis* have as yet been obtained.

The rhizoids of *Ricciopsis Florinii* are of considerable interest from a systematic point of view. Those being multicellular, with oblique transversal cell-walls, are reminiscent of the rhizoids seen in the *Musci* rather than of those found in the *Hepaticae*. The rhizoids of *Marchantiolites* are rather incompletely known; they were probably similar to those of the living *Marchantiales* (smooth and tuberculate rhizoids).

If we summarize the evidence on the mother plants obtained from a study of the morphological characters of *Ricciopsis*, *Marchantiolites*, and *Ricciisporites* we arrive at the following conclusions:

Ricciisporites is most probably the spore of *Ricciopsis*; both genera may correspond to plants habitually similar to the modern Riccias. *Marchantiolites* may either correspond to true *Marchantiineae* or to forms intermediate between the *Ricciineae* and the *Marchantiineae* (*Ricciopsis scanica*=*Marchantiolites porosus*?).

Rewiew of Fossil Finds of Hepaticae, with Special Regard to the Marchantiales.

Remains of thalloid plants superficially resembling Liverworts have long been known, although in limited numbers, and described under different names, e.g. as *Marchantites* Brongniart (cf. p. 386). Their structures and affinities to living Bryophyta are in many cases unknown, however, and it is doubtful whether they are the remains of Bryophytes or Algae.

Liverworts of the Palaeozoic. — It was not until 1925 that more exact information of the existence of *Hepaticae* in the Palaeozoic was obtained, thanks to a well-known publication by Walton on "Carboniferous Bryophyta" (followed by a second part in 1928). Walton revived the genus *Thallites* Kidston as a formname of fossils of unknown affinities, the plant bodies of which are of thalloid form, such as may be found in the *Algae*, *Bryophyta*, and occasionally in higher groups (fern prothallia). For remains definitely pointing to a relationship to living *Hepaticae* (in practice mostly rhizoids) he introduced the genus *Hepaticites* Walton (cf. p. 386). The excellently preserved material studied by Walton was obtained from the British Upper Carboniferous. A revised list of the species, including comparisons with modern forms, is given below (from Harris 1939, p. 70):

Hepaticites Kidstoni Walton 1925, 1928, cf. *Treubia*.
Hepaticites lobatus Walton 1925, 1928, cf. *Fossombronia*.
Hepaticites Langi Walton 1925, 1928, cf. *Riccardia* (*Aneura*).
Hepaticites metzgerioides Walton 1928, cf. *Metzgeria*.

Walton's material consists of sterile fragments of cellular structure, and was compared by him to the living Anacrogynous Jungermaniales.

A fossil thalloid plant from the British Carboniferous described by Walton in 1949 under the designation "cf. *Hepaticites* sp." is of considerable interest to a direct comparison with the material from

Scania described under *Ricciopsis* nov. gen. It is refigured in Fig. 1 D for comparison to *R. Florinii;* there is a striking general resemblance of WALTON's figure to our Pl. I: 1. WALTON considered the relationship of the British specimen to the *Hepaticae* uncertain, however, and states that the chief interest of the plant, apart from its botanical nature, lies in the mode of growth suggested by its fossil remains; he draws attention to the fact that the living *Riccia* forms similar rings of branches by the decay of the central region.

Thallites Willsi WALTON — originally described as *Hepaticites Willsi* — is of considerable interest in connection with the thalloid plant discussed above. It belongs to the material from the British Upper Carboniferous described by WALTON in 1925, but was later (1949) in view of its lack of rhizoids, etc., transferred to *Thallites.* The plant was said to have much the same life-form as *Riccia fluitans* (WALTON 1925, p. 569) but was later compared to *Riccardia* (WALTON 1928, p. 712) since no air-chambers or large intercellular spaces were observed. In his 1949 paper, however, WALTON points out (op. cit., p. 280) the resemblance of the fossil reproduced here as Fig. 1 D to *Thallites Willsi;* the relationship of the latter to the *Hepaticae* is as yet considered uncertain. That *Thallites Willsi* is said to have spore-tetrads embedded in its thallus (WILLS 1914, p. 388) is of great interest. Unfortunately, WALTON (1925, p. 568) was not able to confirm this statement.

I take this opportunity to draw attention to a plant from the Carboniferous of New Brunswick, described as *Rhizomorphia lichenoides* by MATTHEW (1907, p. 186, Pl. 1, Fig. 1; for the age of the material, cf. MATTHEW 1911). Its description runs as follows:

"A rather thick thallus growing from a central point and radiating in all directions. Method of branching of the lobes dichotomous; growth of the lobes not equal but some branches extending more rapidly than others; the outer forks of the lobes of thinner texture than the inner, older ones.

Certain disk-like and more shining spots on the surface of the thallus may indicate the sporangia of this plant; they are from 1 to 1 ½ mm in diameter."

The name of this plant should now be *Thallites lichenoides* (MATTHEW) n. comb. It is said to occur in association with fern leaves and stems of *Calamites*, and may thus probably be a land plant. MATTHEW thinks that the mode of branching, radiating growth, and thick thallus, point to affinities to Lichens or Fungi, and JONGMANS (1911, p. 10) has referred it to the first of these groups. It does not seem unlikely, however, that the material might as well represent a xeromorphic Hepatic related to the Riccias.

Liverworts of the Older Mesozoic Floras. — The following species from the older Mesozoic flora (Trias — Lower Cretaceous) have been compared to members of the living Anacrogynous *Jungermaniales* (cf. HARRIS 1939, 1942):

Hepaticites glebosus HARRIS 1931. Lower Lias, East Greenland, cf. *Moerckia flotowiana.*

Hepaticites laevis HARRIS 1931. Lower Lias, East Greenland, cf. *Pellia epiphylla.*

Hepaticites solenotus HARRIS 1938. Upper Rhaetic, England, cf. *Riccardia* (*Aneura*) *incurvata.*

Hepaticites arcuatus HARRIS 1942. Middle Jurassic, England, cf. *Pellia.*

The following species has been compared to the *Sphaerocarpineae* (*Sphaerocarpales*):

Naiadita lanceolata (BUCKMAN) HARRIS, HARRIS 1938, 1939. Upper Rhaetic, England, cf. *Riella.*

The affinities of the following species of *Hepaticites* are unknown:

Hepaticites amauros HARRIS 1937. Lower Lias, East Greenland.

Hepaticites Rosenkrantzi HARRIS 1931, 1937 Lower Lias, East Greenland.

Hepaticites Wonnacotti HARRIS 1942. Middle Jurassic, England.

Our discussion will be limited to these three species.

Hepaticites amauros (HARRIS 1937, pp. 6—7) is slightly reminiscent of *Ricciopsis scanica* (p. 393), but there is no clear evidence that it should be placed in the *Marchantiales;* STEERE (see p. 393) suggests affinity to the Anacrogynous *Jungermaniales.*

One feature of *Hepaticites Rosenkrantzi* (HARRIS 1931, p. 4; 1937, pp. 5—6), viz. the presence of structures recalling gemma cups on the surface of the thallus, is reminiscent of *Marchantia.* There is, however, no definite reason why the rather poor fragments should be ascribed to the *Marchantiales.*

Hepaticites Wonnacotti HARRIS (1942, pp. 397—401) resembles the *Marchantiineae* in its rather large dimensions and the presence of ribs in the lamina (cf. *Ricciopsis scanica,* pp. 391—392, and *Marchantiolites porosus,* p. 395), and above all in the presence of surface bulges in rows parallel with the ribs of the lamina. According to HARRIS, these may be mere corrugations of the thallus, or else air chambers like those of *Conocephalum* or *Marchantia.*

The above list represents the species of Hepatics that may safely be included in the group, seeing that their Liverwort affinities have been confirmed by microscopical investigation of the plant remains.

Thallites is the proper generic name for uncertain records of thalloid Liverworts from the Mesozoic (cf. pp. 385—386 and HARRIS 1942). The following species may be worth mentioning in this connection:

Thallites Rostafinskii (RACIBORSKI) HARRIS, RACIBORSKI 1888, 1894; Lower Lias, Poland.
Thallites marchantiaeformis (SAPORTA) SAPORTA 1894, TEIXEIRA 1948; Upper Jurassic, Portugal.
Thallites Zeilleri (SEWARD) HARRIS, SEWARD 1894, HARRIS 1942; Wealden, England.
Thallites Sewardii (BERRY) BERRY 1920; Lower Cretaceous, U.S.A. (Maryland).
Thallites blairmorensis (BERRY) BERRY 1929; Lower Cretaceous, Canada.
Thallites Yabei (KRYSHTOFOVICH) HARRIS, KRYSHTOFOVICH 1929, 1933, ÔISHI 1940; Upper Jurassic — Lower Cretaceous, Siberia, Korea, Japan.
Thallites uralensis, KRYSHTOFOVICH & PRYNADA 1933; Rhaetic-Lias, U.S.S.R. (Eastern Urals).

Thallites Rostafinskii is perhaps better known by its old name, *Paleohepatica Rostafinskii*. It was found at Grojec near Krakow, one of the main rich floral localities of the Lower Lias in Poland. The specimen shown in Fig. 1, Pl. 7, of RACIBORSKI 1894 is in general habit strongly reminiscent of the *Marchantiineae*; it is a rather large plant. (The Liverwort affinities of the specimen seen in Fig. 2, Pl. 7, op. cit., seem to be doubtful.) The Polish text mentions explicitly, however, that it differs from *Marchantia*: the impressions show neither polygonal areolae[1] with median lines, nor rhizoids on the lower side of the vein running in the middle of the segment (RACIBORSKI 1888, p. 8; 1894, p. 11). According to RACIBORSKI (1888, p. 8; 1894, p. 12) it is impossible to determine exactly the systematic position of the impression from Grojec; the remains may belong to the family *Marchantiaceae* and the genus *Marchantia*, but may as well be ascribed to the *Jungermanniaceae*, some forms of which, e.g. *Metzgeriae*, *Haplolaenae* and *Diplomitriae*, have a similar thallus.

Thallites marchantiaeformis (SAPORTA) was found at Cabanas de Torres in Portugal; this flora is of Late Jurassic age (Kimmeridge-Portland). The preservation of the material is said to be far from perfect. For particulars

[1] HIRMER's "Handbuch der Paläobotanik" (1927, p. 141) gives the following information about "*Palaeohepatica Rostafinskii*": "Die Erhaltung dieser Reste ist so gut, dass man die Luftkammergrenzen noch erkennen kann." This statement is apparently based on the general impression given by RACIBORSKI's Fig. 3, Pl. 7 (1894), but is not confirmed by the Polish text; RACIBORSKI only says that he could distinguish long cells—20 μ wide and 10—15 times longer—on the median vein; nothing more was observed on the surface.

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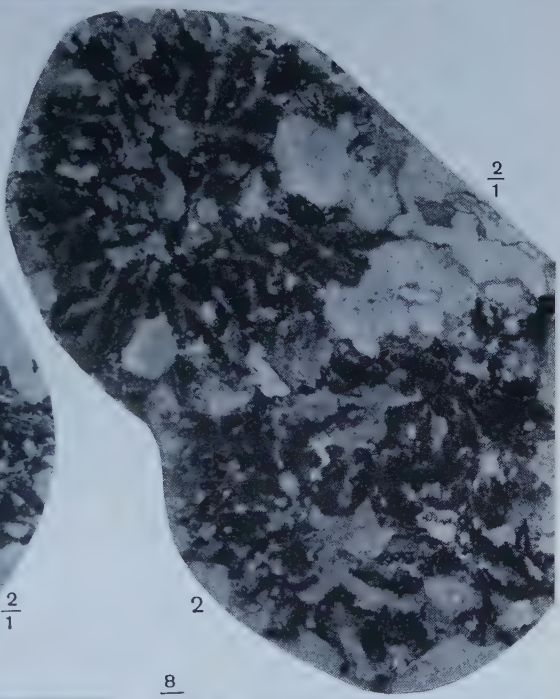

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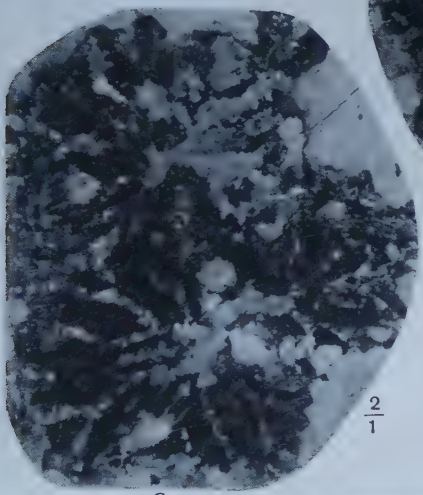

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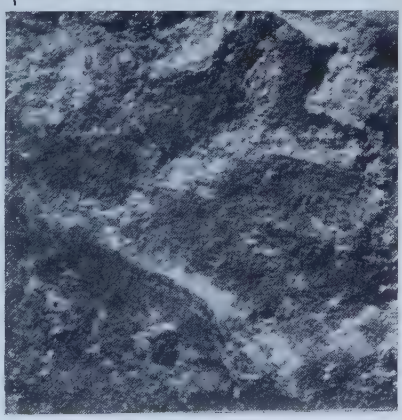

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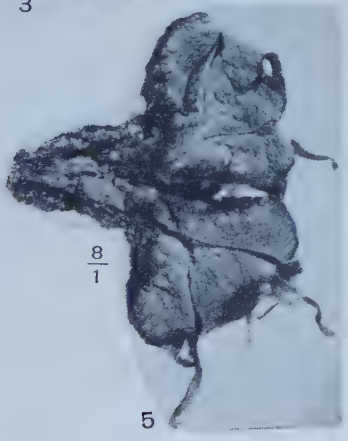

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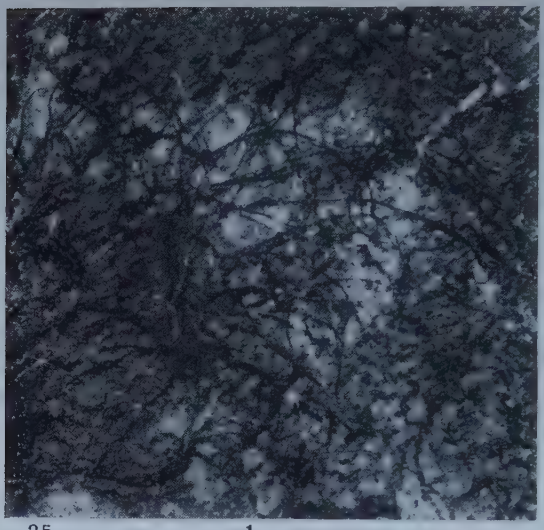

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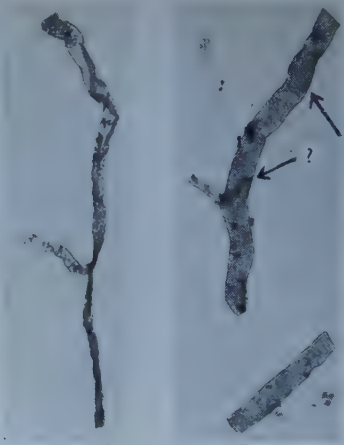

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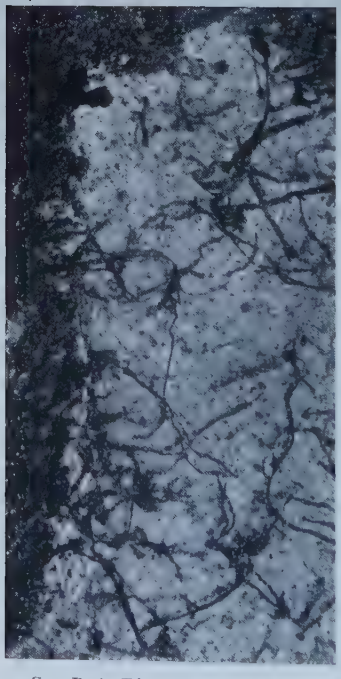

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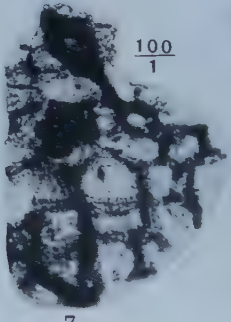

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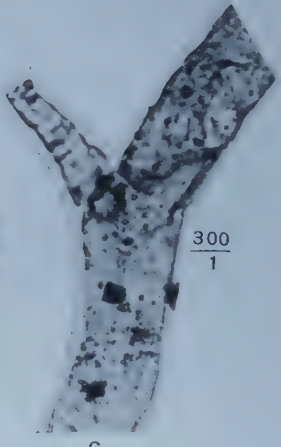

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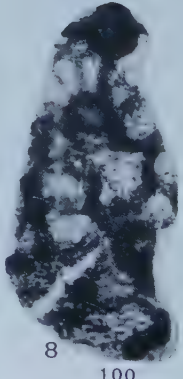

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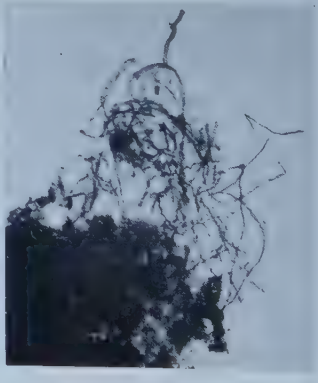

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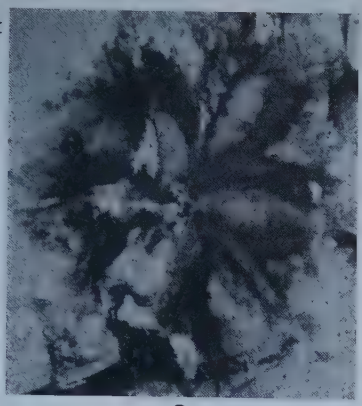
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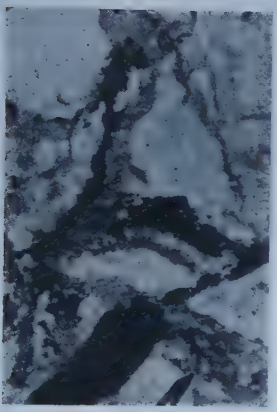
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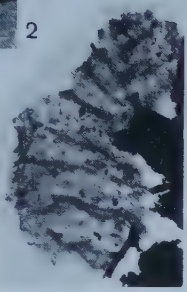
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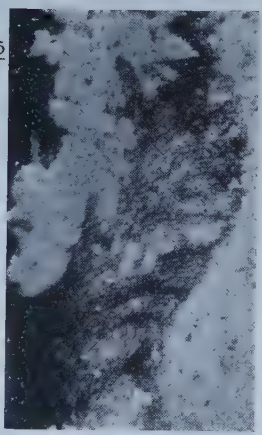
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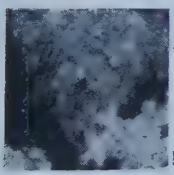
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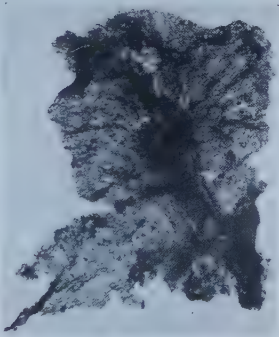
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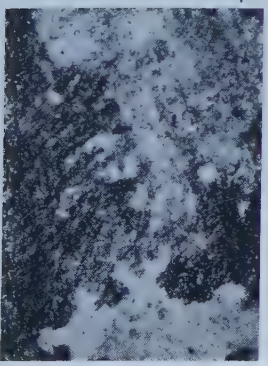
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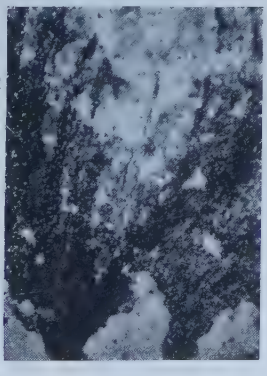
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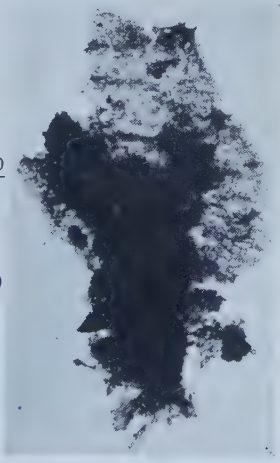
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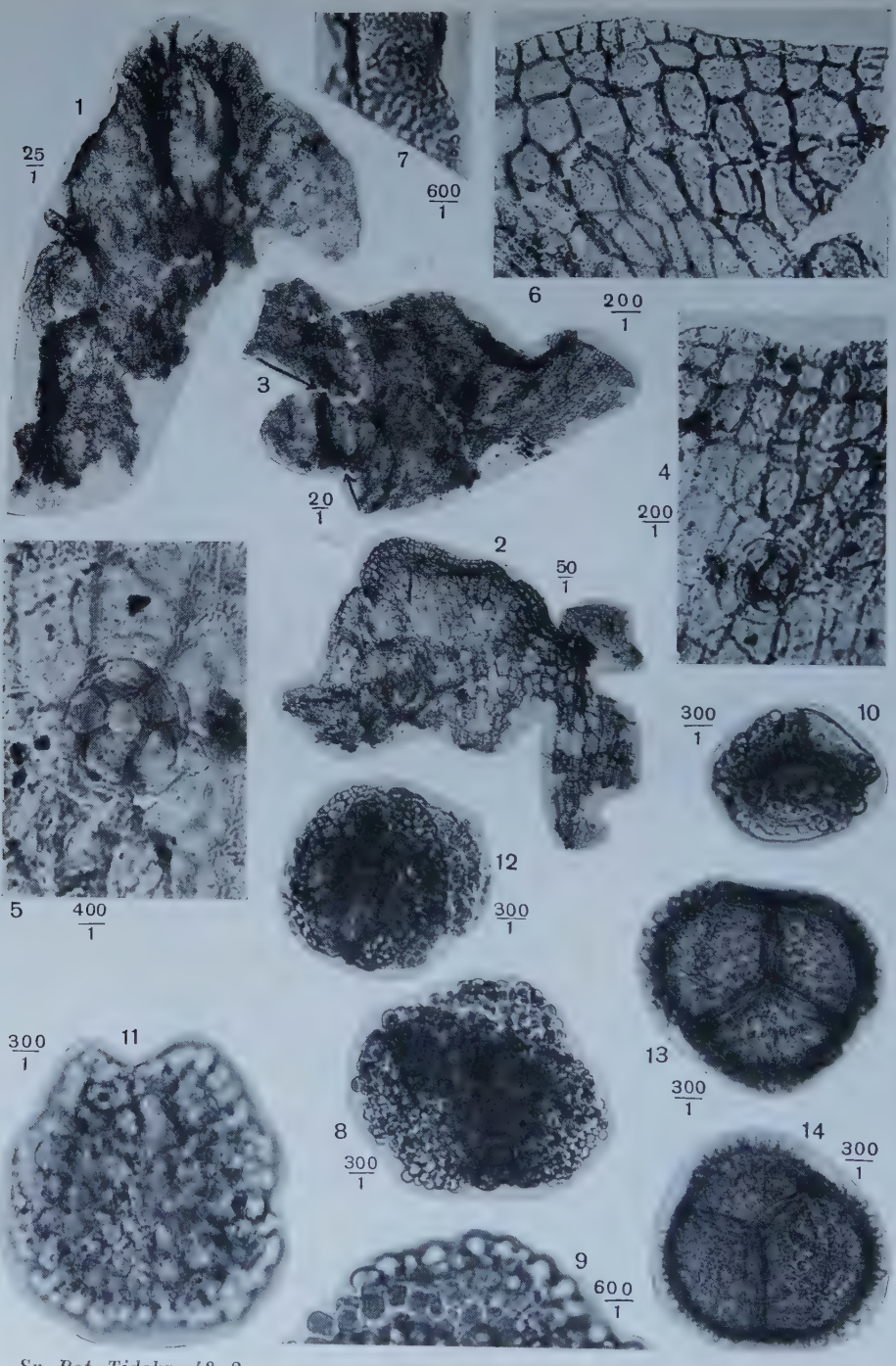
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see Saporta 1894, p. 41; Pl. 4, Figs. 9 a, 17, and Teixeira 1948, p. 25; Pl. 14, Fig. 1.[1]

Thallites Zeilleri (Seward) Harris, from the British Wealden, was originally described by Seward (1894, pp. 18—19, Pl. 1, Fig. 3) as *Marchantites Zeilleri*; its closer affinities are unknown.

Thallites Sewardii (formerly *Marchantites Sewardi*) was described by Berry (1920, pp. 50—52; Fig. 2) from the late Lower Cretaceous at Federal Hill, Maryland. It shows dichotomizing segments with thickened medial midrib-like portions; the systematic position of this plant is not known.

Thallites blairmorensis was originally published by Berry (1929, pp. 34 -35, Pl. 4, Figs. 1—2) as *Marchantites blairmorensis*; it belongs to the Lower Blairmore flora of Alberta (Lower Cretaceous). Steere (1946, p. 304) keeps the species under the generic name proposed by Berry; he compares the thallus with the living *Conocephalum conicum*. The dichotomously branched segments are large enough to suggest affinity with the *Marchantiaceae*. Rhizoids are said to be borne on the thallus, but no particulars are given of their structure.

In size and shape *Thallites Yabei* (Kryshtofovich) Harris is very similar to the species from Canada discussed above. This applies in particular to the type material from the Lower Cretaceous of South Ussuriland in Siberia (Kryshtofovich 1929, pp. 144—147; Pl. 15, Fig. 3; for the age of this flora, cf. Kryshtofovich 1933, pp. 54, 117, 121), which is of somewhat larger dimensions than the other material referred to this species (cf. Kryshtofovich 1933, Pl. 6, Fig. 1, and the material quoted below. The specimen described by Yabe (1905, pp. 41—43; Pl. 3, Fig. 11 a) as *Sagenopteris bilobata*—from a plant bed of Upper Jurassic age in the Naktong Series of Korea (cf. the Stratigraphic Table in Ôishi 1940, pp. 168—169) — is fragmentary and unsatisfactorily known, but may represent a similar type. Kryshtofovich (1929, pp. 145—146) mentions a rugulosity on the surface of the thalli in the material from Siberia and Korea, a feature which may possibly suggest affinities to the *Marchantiineae* (cf. p. 407). Ôishi (1940, pp. 183—185; Pl. 1, Fig. 1) refers material from various localities in Japan to Kryshtofovich's species; the records quoted by him correspond to Upper Jurassic and Lower Cretaceous strata.

Thallites uralensis Kryshtofovich & Prynada (1933, pp. 7—8; Pl. 1, Fig. 6, Pl. 3, Fig. 12, Pl. 4, Fig. 5, Pl. 5, Figs. 3, 6, 7 a, 9) was founded on material from the Rhaetic-Liassic deposits of the Cheliabinsk basin in the Eastern Urals. The illustrations are unsatisfactory, but it appears from the description as if the lamina of this species had ± distinct, arcuate ribs, giving the impression of a dense, reticulate venation of *Sagenopteris* type. Arcuate, vein-like ribs are often seen in the *Marchantiales* (cf. p. 399). According to the description, a sunken, dark zone is visible in the middle of the segments (cf. p. 390).

For further references to material of *Thallites*, see Fliche & Bleicher

[1] The "*Jungermannites vetustior*" of Saporta 1894 (Lower Cretaceous, Cercal) is included by Teixeira (1948, p. 75) in *Choffatia Francheti* Saporta.

1882 (p. 16, Fig. 1), KRYSHTOFOVICH & PRYNADA 1932 (p. 364), and KRYSHTOFOVICH 1941 (pp. 282, 323).[1]

The *Marchantites*? sp. of HALLE 1913 *b* (p. 20; Pl. 5, Figs. 14–16) from the Upper Jurassic-Wealden deposits of the Rio Fosiles valley near Lago San Martin is not considered in our discussion; this material will be redescribed later.

The *Schizolepidella gracilis* HALLE (1913 a, pp. 90—92; Pl. 9, Figs. 18—21; text-fig. 19) must be mentioned in this review, although it is valueless for any direct comparison with the Scanian material. It came from the Hope Bay flora of Graham Land, which according to HALLE (op. cit., p. 103) is of decidedly Jurassic character. HALLE (p. 92) pointed out the great habitual resemblance of *Schizolepidella* to leafy Liverworts; this agreement is further emphasized in FULFORD 1951 (p. 244).

Liverworts of Upper Cretaceous and Tertiary Floras. — For particulars of finds of *Hepaticae* in Upper Cretaceous and Tertiary floras I refer to SEWARD 1898 (pp. 230—236), HIRMER 1927 (pp. 138—144), STEERE 1946 (pp. 304—310), FULFORD 1951 (pp. 244—245), and MÜLLER (1951, pp. 3—7); cf. also GAMS 1932 *b*. It is outside the scope of the present paper to review these finds in detail, but attention may be drawn to some circumstances of particular interest to comparisons with material of higher geological age.

I do not know of any satisfactory records of *Marchantiales* from the Upper Cretaceous, but the presence of Liverworts in the floras of this time is suggested by a few findings.—Minute reticulations seen in the plant body of *Thallites yukonensis* (HOLLICK) n. comb., of the Upper Cretaceous of Alaska (see HOLLICK 1930, p. 37; Pl. 1, Fig. 2) are by STEERE (op. cit., p. 305) held to represent the outlines of Marchantiaceous air-chambers, but the material is very poor. — *Thallites Wardii* (KNOWLTON) is an interesting form from Montana, originally described as *Preissites Wardii* (KNOWLTON 1894, pp. 458—460, Figs. 1—3), which according to STEERE (op. cit., p. 306) should be compared with *Ricciocarpus* rather than with *Preissia*. It was found in strata usually referred to Eocene, but possibly of Uppermost Cretaceous age.[2]

[1] The leaf fragment of the Jurassic flora of Oregon published by WARD (1905, p. 53; Pl. 6, Figs. 1—2) as "*Marchantites erectus* (Bean) Seward?" is evidently a fragment of a fern (a note in pencil in NATHORST's handwriting in the Riksmuseum copy of WARD's paper suggests *Hausmannia*). Cf. STEERE 1946, p. 320.

[2] STEERE (1946, p. 307) quotes *Jungermannites cretaceus* BERRY (1919, p. 49; Pl. 5, Figs. 2—3) from the Tuscaloosa formation of Alabama (Upper Cretaceous) in his list of the fossil members of the *Jungermaniales Acrogynae* from North America. He points out, however, that the systematic position of the plant is highly problematical. There

The Liverworts of the Tertiary show very close affinity to living Hepatics; many recent genera have been recognized in the flora of the amber. Of particular interest in this connection is the well-preserved material of *Marchantites sezannensis* BRONGNIART (SAPORTA 1868, pp. 308—312; Pl. 1, Figs. 1—8) from the travertine of Sézanne in the Province of Marne (Eocene); this plant clearly belongs to the *Marchantiaceae*. It has not only the vegetative characters of the family (presence of air-pores), but also pedunculate reproductive structures similar to the disciform male receptacles of *Marchantia;* supposed gemma cups occur on the surface of its thallus.

Summary.

This paper is mainly an account of fossil Liverwort material from the Liassic of Skromberga (Province of Scania, Sweden).

Rather complete sterile thalli resembling *Riccia* are described as *Ricciopsis Florinii* and *Ricciopsis scanica* n. spp., and fragmentary segments of thalloid Hepatics with air-pores similar to those of the *Marchantiineae* are described as *Marchantiolites porosus* n. sp. Spore tetrads comparable with those of the living *Riccia Curtisii* are described as *Ricciisporites tuberculatus* n. sp. The systematic positions and interrelations of the new genera *Ricciopsis*, *Marchantiolites*, and *Ricciisporites* are discussed. *Ricciisporites* is most probably the spore of *Ricciopsis*; both genera may correspond to plants habitually similar to the modern Riccias. *Marchantiolites* may either correspond to true *Marchantiineae* or to extinct forms, possibly intermediate between the *Ricciineae* and the *Marchantiineae*.

Previous findings of fossil material of the *Hepaticae*, with special reference to the *Marchantiales*, are reviewed in this connection. Only four certain records of Hepatics are known from the Palaeozoic. The number of satisfactory records from the Mesozoic is greater, five forms with preserved cellular structure of thallus and rhizoids being known; many doubtful references to fossil Hepatics are, however, found in the literature.

The Swedish material affords conclusive evidence that plants with indubitable *Marchantiales* characters existed in the Older

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is in my opinion a strong external resemblance between this fossil and anisophyllous shoots of *Selaginella* (cf., for instance, LUNDBLAD 1950, Pl. 1, Figs. 4—5) but the dimensions of the shoots seem to differ.

Mesozoic. This is confirmed by suggestions from other sources indicating that the major groups of Hepatics might have been differentiated as early as in the Palaeozoic.

Acknowledgements.

I am indebted to Dr. Herman Persson for some references to the literature on living *Hepaticae*, particularly a couple of papers by Fulford. Dr. Sigfrid Arnell—the Swedish specialist on living Riccias—has taken the trouble to read the manuscript before it went to the press, and I wish to thank him for some remarks on the text on that occasion. I am indebted to the editor of this journal, Dr. Sten Ahlner, for some remarks on the description of the new species, and for information about Arnold's contribution to this issue of Svensk Botanisk Tidskrift. The photographs have been taken by Mr. K. E. Samuelsson, who has also made the balsam transfers required for the investigation.

Riksmuseets paleobotaniska avdelning, Stockholm, February 1954.

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Explanation of Plates.

The figured specimens and slides are the property of the Palaeobotanical Department of the Swedish Museum of Natural History, Stockholm. — K. E. Samuelsson phot.

Plate I.

1—4. *Ricciopsis Florinii* n. sp. — Skromberga, roof of upper coal bed (Prov. of Scania, Sweden). Liassic.

1. Thalli (type material). — 1/1.

2. Thalli, enlarged. Immersed in xylol. — 2/1.

3. Thalli, enlarged; the one lower down in the picture is regarded as the holotype. Xylol. — 2/1.

4. Portion of one of the thalli shown in 3 (the holotype), showing median furrows in the segments. — 8/1.

5. *Ricciocarpus natans* (L.) Corda — Sweden (Prov. of Närke): Hammar. Recent. B. Lundblad 21.VI. 1953. (For the locality cf. Lohammar 1940, p. 474). — 8/1.

Plate II.

Ricciopsis Florinii n. sp. — Skromberga, roof of upper coal bed (Prov. of Scania, Sweden). Liassic.

1—2. Lower side of thallus, showing rhizoids. Balsam transfer made of the specimen to the left in Pl. I: 1. Picture 1 is taken in reflected light, 2 in transmitted as well as in reflected light. — 25/1.

3. Fragment of thallus, with rhizoids still attached. Material detached from the balsam transfer of the specimen seen to the left in Pl. I: 1. — 25/1.

4—5. Rhizoid ramifications. Position of supposed walls indicated by arrows. — 100/1.

6. Portion of one of the rhizoids in 5, enlarged. Indistinct perforations are suggested in the wall. (The supposed cell-wall may in this case be a fold.) — 300/1.

7—8. Fragments of thalli, showing epidermal structure. Material removed from the balsam transfer of the specimen to the left in Pl. I: 1. — 100/1.

Plate III.

1—5. *Ricciopsis scanica* n. sp. Skromberga, roof of upper coal bed (Prov. of Scania, Sweden). Liassic.

1. Thallus (holotype). — 1/1.

2—3. The same, enlarged (in 3 the specimen is immersed in xylol). — 4/1.

4. Portion of the thallus shown in 2—3, more enlarged to show the presence of ribs in the lamina. — 25/1.

5. Same portion, photographed at lower magnification (red and yellow shades in the fossils are removed by the use of special filters). — 12/1.

6—8. Cf. *Ricciopsis scanica* n. sp. Skromberga, roof of upper coal bed (Prov. of Scania, Sweden). Liassic.

6. Fragmentary thallus. — 4/1.

7. Portion of the same, showing ribs in the lamina (cf. 4—5). — 25/1.

8. Enlarged portion of the thallus in 6, showing its ribs and cellular structure. — 25/1.

9—11. *Marchantiolites porosus* n. sp. Skromberga, roof of upper coal bed. (Prov. of Scania, Sweden). Liassic.

9. Fragmentary segment. Some rhizoids may be seen at the lowermost end of the structure. — 20/1.

10. Segment with square apex. — 20/1.

11. Fragmentary segment showing ribs. — 25/1.

Plate IV.

1—7. *Marchantiolites porosus* n. sp. Skromberga, roof of upper coal bed (Prov. of Scania, Sweden). Liassic.

1. Distal portion of segment (holotype). — 25/1.
2. Fragmentary segment with lobate margin. — 50/1.
3. Fragmentary segment. A structure possibly representing a ventral scale is seen to the left (arrows). — 20/1.
4. Part of segment with air-pore (cf. fig. 3 D). — 200/1.
5. Air-pore from the same specimen, enlarged. — 400/1.
6. Lamina with two sets of cells. — 200/1.
7. Portion of tuberculate(?) rhizoid, from the specimen shown in Pl. III: 9. — 600/1.

8—11. *Ricciisporites tuberculatus* n. sp. Skromberga, roof of upper coal bed (Prov. of Scania, Sweden). Liassic.

8. Spore tetrad (holotype). — 300/1.
9. Portion of spore wall, enlarged, photographed to show reticulate perinium. — 600/1.
10. Single spore(??). Presence of equatorial margin suggested? — 300/1.
11. Spore tetrad, photographed to show reticulate perinium. — 300/1.
12. *Ricciisporites tuberculatus* n. sp. Spore tetrad. Höllviken II, 1480.78—1485.44 m (Prov. of Scania, Sweden). Rhaetic. — 300/1.

13—14. *Riccia Curtisii* T. P. James, Cape Province, leg. Sigfrid Arnell 30.VIII 1951. Spore tetrads photographed to show reticulate sculpture of wall. — 300/1.

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ON THE SUPPOSED OCCURRENCE OF BLECHNUM LONGICAUDA C. CHR. IN BRAZIL.

BY

C. SKOTTSBERG.

In Serra do Caparaó at the boundary between Minas Gerais and Espirito Santo Dr. A. C. Brade found, in 1941, a species of *Blechnum*, unknown to him and not reported before from Brazil, growing on the bank of Rio Domingos at about 2000 m altitude. The only specimen found was sterile and thus left unnamed awaiting the discovery of spore-bearing fronds. Dr. Brade did not, however, find occasion to return to the locality, but in 1948 he came upon fertile plants in Serra da Mantiqueira, and he had the kindness to send me a fine specimen. The locality is given as "Minas Gerais: Passa Quatro, Sertão dos Martins 1400 m 8.V. 1948". The species belonged to subg. *Lomaria* and was so similar to *B. longicauda* C. Chr., endemic on Masafuera (Juan Fernandez Is.), that the two seemed to be identical. For comparison Brade had Christensen's description and plate, representing a large, proliferous sterile frond (2 p. 10), collected by me in 1908 (n. 465, UPS). It escaped Brade that the description had been completed and new illustrations added after I had collected new, fertile material in 1917 (3 p. 29).

Christensen had shown that his new species was closely related to *B. Sprucei* C. Chr. (*Lomaria caudata* Baker 1867 non *Blechnum caudatum* Cav. 1802) from Ecuador and that these two species stand apart from the other members of the subgenus. *B. Sprucei* differed from *longicauda* mainly by its smaller size, in the shape of the pinnae and by the more or less densely pubescent rhachis, this being glabrous in the latter.

Brade (1) who did not have access to any specimens of either species concluded from the original descriptions and Christensen's

plate that his plant did not agree too well with *B. Sprucei* whereas it came very close to *longicauda*, and on his label he calls it *longicauda* var. From a geographical viewpoint this was surprising; one would expect the Brazilian plant to stand closer to a species known from Ecuador and Bolivia than to one from distant Masafuera. My particular interest in the flora of Juan Fernandez induced me to take up the matter for a revision based on sufficient material. Kew graciously sent me their material as loan, including the type of *B. Sprucei*, all from Ecuador, and the Stockholm herbarium contains several specimens, also from Bolivia. Of *B. longicauda* I had access to the type (UPS) and to my ample collection of 1917 (S, GB, UPS).

The two species are of the same habit, general appearance, texture and, as far as can be judged from the dried plants, colour. They also share the linear-lanceolate, long-pointed, dark brown and glossy scales on the caudex and stipe.

Blechnum Sprucei.

Baker's type of *Lomaria caudata* from Tunguragua in the Andes of Ecuador, Spruce 5329, matches the diagnose exactly (4 p. 179). It is shown in Fig. 1. The sterile frond is 70 cm long and 10 cm wide, the pinnae to 5 cm long and 1.25 cm wide and, as Baker says, "narrowed suddenly to the point, the rhachis and midrib more or less chaffy". In addition to the type specimen there is another from the same region (K, Fig. 2); on the sheet is written "an 5662. potius 5329". The sterile frond measures about 60 by 9 cm, the longest pinnae 5 by 1.2—1.3 cm, just as in 5329, but most of them are rounded-obtuse, only few show the triangular apex characteristic of the middle region in the type. The rhachis is pubescent with brown, possibly glandular hairs (a single row of cells) and bears scattered, light brown, small and very thin scales. Such scales are also scattered on the midrib below of the pinnae. The pubescence appears to wear off quite easily. About the margin of the pinnae Baker said nothing: "es muss daher angenommen werden, dass die Fiedern ganzrandig sind" says Brade l.c., and this seems to be true of the type, where the edge is so tightly revolute that the very margin is hidden, but in 5662 it is distinctly crenulate just as in all other specimens.

In his Fern Flora of Ecuador Sodiro lists *Lomaria caudata*, of which he had collected a single young specimen in Valle Lloa on

Fig. 1. Type specimen of *Lomaria caudata* BAKER (*Blechnum Sprucei* C. CHR.).

Fig. 2. *Blechnum Sprucei*, second sheet, presumably part of SPRUCE's original collection but not used for the description of *Lomaria caudata*.

Mt. Pichincha at 2800 m above sea level (6 p. 119—120). The sterile fronds were only 25—40 cm long and 5—7 cm wide, the short pinnae are described as blunt, the rhachis as tomentose and sparingly squamose, the midrib of the pinnae as slightly squamulose. This specimen must have been rather like SPRUCE's plants, only much less developed. But from the same locality comes another specimen, collected by SODIRO at a much later date (S, formerly in ROSENSTOCK's collection), labelled in ROSENSTOCK's hand "in m. Pichincha 3.04 l. Sodiro". It is a large sterile frond (Fig. 3), 116 cm long and 16 cm wide, the longest pinnae 8—9 by 1.5 cm. The rhachis is densely tomentose and bears scattered scales, the midrib below of the pinnae more or less squamose as also the lateral veins. But, and this is of some importance, the pinnae of the middle region are acuminate, with an acute point longer than in the type. The edge is densely crenulate.

ASPLUND 8061 from Tunguragua, vicinity of Patate 2800 m, 5.8 1939 (S) is a sterile frond 135 cm long and 11—12 cm wide. In shape the median pinnae agree with the type, being suddenly contracted, in cases even slightly cuspidate; their margin is faintly crenulate toward the tip but otherwise even. It is a young and tender frond. Pubescence as in the former, scales on midrib plentiful and minute scales on the side-veins observed also on the upper surface.

E. K. BALLS 6267 (K), Bolivia, prov. Chapare, Dept. Cochabamba, Aduana Llanta 16.3. 1939, 12000 ft. A single sterile frond, *c.* 114 by 10 cm. Pinnae acuminate, about 5 cm long and 1 cm wide. Pubescence as in ASPLUND 8061, but only the lower surface exposed. Beside the tiny scales on the veins also a few soft whitish hairs were observed.

J. STEINBACH 9525 (S). Same district as the former, 6.3 1929, 3100 m. Very similar in all respects to BALLS 6267, but complete with caudex and one young fertile frond.

Blechnum longicauda.

To judge from my material this seems to be a much larger and coarser plant with fronds 2—3 m long and 26—33 cm wide and with gradually narrowed, long acuminate pinnae of 12—16 by 2 cm, but as it is unlikely that the specimens of *B. Sprucei* that I have seen represent anything like the maximum size, the difference between the two may not be as great as supposed by CHRISTENSEN.

Fig. 3. *Blechnum Sprucei*, specimen collected by Sodiro.

The stoutness of the stipe and rhachis is, however, obvious; the stipe (the thickened base not considered) measures as much as 6 mm in diameter, the rhachis is 4—5 mm wide, sulcate above and glabrous; stipe of *Sprucei* to 4 mm thick, rhachis 3 mm wide and pubescent. And it is the character of the indument that interests us here. To quote CHRISTENSEN's diagnose: "Rachi validiuscula, glabra ... pinnis ... supra virentibus glabris, infra pallidioribus ad costas venasque pilis albidis pluricellularibus et squamis paucis tenuibus, anguste linearibus vel filiformibus sparsim instructis." When this was written only n. 465, the type specimen, existed, but the ample collection made in 1917 shows the same characteristics. Only the tip of the growing frond is chaffy with minute scales in n. 420, more of them left on n. 365 (GB). In this the long whitish hairs, in cases to 1 mm long and formed by 6—7 cells or more, the end cell being slightly swollen, are quite plentiful. In principle there is no difference between these delicate, more or less straight hairs and the perhaps somewhat shorter, brown and curly hairs in *B. Sprucei*; there are transitions between them, and a close examination of an adventitious plant of *longicauda* 420 (S) revealed the presence in the uppermost part of the rhachis of a fugacious cover of brownish hairs. Besides, as Fig. 4 shows, there is good agreement in the shape of the pinnae with the type of *Sprucei*, but to judge from SODIRO's plant (Fig. 3), the pinnae of the larger frond are relatively longer and more acuminate in other cases.

My comparison between sterile fronds of the two species has not brought to light any distinguishing characteristics not observed before but has rather lessened the difference between them. One more character deserves, however, to be mentioned. The naked portion of the base, the stipe proper, is only 3 to 5 or 6 cm long in *longicauda*, whereas the distance from the base to the first reduced pinna is 5 to 15 cm in *Sprucei*.

With regard to the fertile fronds these are much larger in *longicauda*, the rhachis, which is glabrous, attaining a diameter of 5 mm or more and the spore-bearing pinnae a length of 15 to 20 cm with a width of 3—4 mm when mature (Fig. 5). At the base they are adorned with a pair of obovate to linear-obovate, foliaceous pinnules parallel with the rhachis, and below the fertile pinnae this bears pairs of reduced sterile ones right down to the thickly scale-covered stipe.

Three of the six specimens of *B. Sprucei* seen have a fertile frond, which in the type is quite immature. Even the one of 5662 is slender

Fig. 4. *Blechnum longicauda*, adventitious plant from tip of large frond, the end of which is seen on the right.

Fig. 5. *Blechnum longicauda*, fertile frond (top portion wanting).

with the larger pinnae 8 to 10 cm long only but 4 mm wide and mature. Only the lowermost show a trace of pinnules. With regard to the basal reduced sterile pinnae we find the same difference as in the sterile frond: in *longicauda* they are found right down to the scale-covered stipe, while there is a long naked portion in *Sprucei*; in the type they are altogether missing, in 5662 we meet the first (counted from below) at least 20 cm from the base. If these differences hold good we have no urgent reason to unite the two species, but I suppose that some pteridologists would prefer to regard *longicauda* as a variety of *Sprucei*.

The sporangia and spores are alike in both. Measurements of 20 spores gave 41× 29.1 μ for *Sprucei*, 38.7× 27.2 μ for *longicauda*.

The Brazilian form, Brade 62542.

The sterile fronds reach a length of 1—1.2 m before the first rooting gemma is formed (Brade p. 284); this may be repeated several times, just as in *longicauda*. The specimen at hand has a greatest width of 17—18 cm, and the pinnae are 1.2—1.5 cm broad when mature. They are distinctly crenulate; Brade's assumption that they are entire in *Sprucei* was, as we have seen already, due to lack of material for comparison. In shape the pinnae match Sodiro's specimen, but the stipe and rhachis are much less stout and do not exceed 3 mm in diameter. The indument is described l.c.: "Bei unseren Pflanzen konnten wir meist eine mehr oder weniger dichte Bekleidung der Rachis mit kleinen Schüppchen feststellen, stellenweise war aber Verkahlung eingetreten." This is quite true, but in addition to the small scales we find, as in *Sprucei*, a fugacious cover of the same brown hairs as in this. The fertile frond, which is mature, is quite slender, the pinnae not exceeding 7 cm in length and 2.5 mm in width. The naked portion of the rhachis including the stipe is 17 cm long and there are no reduced sterile pinnae at all; the small irregular structures more or less distinctly seen in Brade's figure are dwarfed fertile pinnae, less than 1 cm long and provided with a minute pair of basal pinnules exactly as in the specimen examined by me. Otherwise no pinnules (lobes, auricles) are developed.

In my opinion Brade's form must be referred to *B. Sprucei*, a taxonomic position in better accordance with its area of distribution. It should be mentioned that the spores are smaller than in either this or *longicauda*: average of 20, 34.8× 25.2 μ.

I have always looked upon *Blechnum longicauda* as belonging to a neotropical element in the fern flora of Juan Fernandez, just as *Elaphoglossum Lindenii* (Bory) Moore (Mex. to Ecuador and Brazil), *Hymenophyllum caudiculatum* Mart. (Peru-Chile, S. Brazil), *Polypodium trichomanoides* Sw. (trop. Amer.) or the endemic *Asplenium stellatum* Colla. Referring to the relations of the flora of Serra do Itatiaia and Serra da Mantequeira to the "Antarctic" and Andine flora Brade assumes a common centre of origin for *Blechnum longicauda* and *Sprucei* in the far south. In fact, the subgenus — or, as it were, genus — *Lomaria* has a circumpolar distribution and belonged, I dare say, to the Tertiary Antarctic flora, i.e. belongs to the Palaeantarctic element in the present-day floras of the South Hemisphere. From this point of view it is indifferent whether the *Lomaria* discovered by Brade is identified with *longicauda* or *Sprucei*. If referred to the latter it will side with other species common to Itatiaia and the Bolivian Andes and quoted by Brade p. 286. The geographical interest rightly attributed to this Brazilian *Lomaria* remains the same apart from our opinion of its taxonomical position.

I am indebted to Mrs. Maria Ferm for the photographs reproduced above.

Botany Dept., Nat. Hist. Museum, Stockholm, May 1954.

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SEKTION AV 2400-ÅRIGT SEQUOIATRÄD.

ETT MÄRKLIGT NYFÖRVÄRV TILL RIKSMUSEETS SAMLINGAR.

AV

ERIC HULTÉN.

Goda och slående botaniska utställningsobjekt äro inte lätta att skaffa fram, det kan var och en övertyga sig om som besöker botaniska skådesamlingar. Blommornas prakt kommer sällan till sin rätt i sådana samlingar, den är för ömtålig och förgänglig. I Amerika har man sökt en ersättning i blommor av glas, dyrbara konstprodukter, som bara amerikanska museer kunna kosta på sig och som med rätta äro uppskattade och beundrade. Större botaniska objekt äro oftast svåra att bevara i någorlunda oskadat skick, svåra att transportera och montera. Man ser därför nästan aldrig stora pelarkaktusar, drakblodsträd, jättelobelior, trädormbunkar eller andra därmed jämförliga märkliga botaniska föremål utställda i de botaniska visningssalarna. Man får nöja sig med fotografier eller delar av dem.

En museichef blir därför alltid glad, om han för sitt museum kan lyckas förvärva något sådant svåråtkomligt praktobjekt, och till dem får man nog räkna sektioner av de kaliforniska jätteträden.

Riksmuseets botaniska avdelning har nyligen erhållit en sådan sektion i gåva av kaliforniska staten, och den har nu uppmonterats i vår utställningssal. Det är en skiva av mammutträdet, »Big Tree» eller »Sierra Redwood», som det numera ofta kallas i Kalifornien.

Då denna sektion troligen är den äldsta i något museum, och då den väl under långa tider kommer att vara ett av de mest slående objekten i vår utställningssal, skall här lämnas en redogörelse för densamma och hur den har förvärvats. För att sätta den in i sitt sammanhang skall även en kort översikt lämnas över de kalifor-

niska jätteträdens ålder och dimensioner samt om deras nutida förekomst och frekvens.

I min strävan att berika museets utställningssal ha länge ingått försök att anskaffa en sektion av ett kaliforniskt jätteträd. De möttes emellertid till en början av föga förståelse, och hur man i allmänhet såg på saken framgår av följande citat ur brev från en kalifornisk institution, som skulle kunna tänkas åstadkomma en sådan sektion: »Mycket sällan kan man finna ett 2 000-årigt träd. Att förfärdiga och forsla fram, emballera och skicka en skiva av ett sådant träd betyder ett stort arbete, och kostnaden skulle bli i det närmaste oöverkomlig. Mycket få sådana sektioner ha åstadkommits och utskeppats.»

Saken fick förfalla, men på den botaniska kongressen i Stockholm 1950 kom jag att nämna saken för dr Lyman Benson, Pomona College. Han lovade att göra sitt bästa för att anskaffa en sektion, men även han möttes av stora svårigheter att realisera planen.

Helt oväntat fick jag en dag i maj 1952 en skrivelse från svenska generalkonsulatet i San Francisco, där uppgifter begärdes angående storlek etc. på den önskade skivan, och den 9 oktober samma år meddelar generalkonsulatet, att Kaliforniens skogsvårdsmyndigheter komma att tillhandahålla en sektion med cirka 12 fots genomskärning och att den är färdig att skeppas om en månad.

I slutet av december 1952 anlände sektionen ombord på Johnsonliniens »Portland» till frihamnen i Stockholm. Museet hade dittills icke haft någon kostnad för densamma. Den var delad i två bitar, som tillsammans med emballaget vägde 9 ton. Dessa båda kollin jämte en större låda med bark transporterades till Riksmuseet, och den metertjocka sektionen lades med hjälp av en större kranbil upp utanför Botaniska museet för att torka över sommaren.

Från de kaliforniska skogsmyndigheterna erhöllos följande uppgifter rörande sektionen:

Den var sågad med en 16 fots (4,9 m) dragsåg ur ett vindfälle, som föll vintern 1940—41 i Mt Home Forest i Tulare County på ungefär 1 950 meters höjd i Sierra Nevada. Sista årsringen torde därför vara den som bildades sommaren 1940. Sektionen togs omkring fem meter över marken, sedan grenarna sprängts bort. En 200 yard lång väg med en glidbana konstruerades ned till närmaste farbara väg. Skivan delades efter en naturlig spricka i två delar, då den var för stor för att forslas hel på Kaliforniens landsvägar, och två halvtums stålkablar med vantskruvar slogos om varje del. De

Fig. 1. Mammutträds-sektionen planas med elektrisk golvhyvel. — Foto E. Hultén.

två först färdigställda sektionerna gingo sönder (troligen emedan de voro för tunna) och först den tredje höll ihop. De båda bitarna emballerades i kraftiga träramar och kördes först till Porterville och därefter till piren i San Pedro, där de togos ombord på Johnsonliniens »Portland».

Hösten 1953 visade det sig, att sektionen torkat ganska obetydligt under sommaren. Tydligen skulle flera somrar behövas för att få den torr, och det bedömdes då bäst att flytta in den i utställningssalen och låta den torka där. Temperaturen i utställningssalen hålls relativt låg under vintern, och torkningen borde alltså inte ske allt för snabbt, så att sektionen spricker sönder onödigt mycket.

Skivan var betydligt tjockare på ena sidan och snittet starkt vågigt; det gällde därför att få den planparallell, innan den togs in. Detta arbete utfördes med hjälp av en kraftig elektrisk kombinerad golvhyvel och slipmaskin och tog ett par veckor i anspråk (fig. 1). När ena sidan planats, vändes sektionen med hjälp av en kranbil (fig. 2), och andra sidan behandlades på samma sätt. De båda bitarna, som under hyvlingen varit sammanpressade med stålkablar, togos isär och transporterades in, var för sig, i utställningssalen, ett

Fig. 2. Sektionen vändes med hjälp av kranbil, sedan den planhyvlats på ena sidan. — Foto E. Hultén.

arbete som tog ett par veckor i anspråk, då de måste lyftas uppför trappan några centimeter i sänder med domkrafter.

Detta besvärliga arbete utfördes av den på tunga transporter mest erfarna firman i Stockholm, A. Z. Sellbergs Åkeri AB., till ett för museet fördelaktigt reducerat pris.

I utställningssalen hopsattes bitarna, den mindre ovanpå den större, och drogos ihop med stållinorna. En cementgrund göts under den på högkant stående skivan, och barken monterades på, varvid stållinorna skuros in i barkens undersida, så att de helt doldes av denna. De båda bitarna passade ej överallt alldeles till varandra, en del ved i sprickan hade tydligen gått förlorad, och mellanrummet fylldes därför av en massa gjord av plastiskt trä och slipspån från skivan. Sektionens ena sida bör poleras, men detta måste anstå tills den torkat, vilket säkert tar flera år i anspråk.

Så som den 70 cm tjocka skivan nu står monterad i utställningssalen, mellan två pelare i salens mitt, kan den ses från båda sidor (fig. 3). Den har en omkrets av 12,22 m, barken inräknad, och en diameter av ca 3,66 m. Vikten torde uppgå till omkring 8 ton.

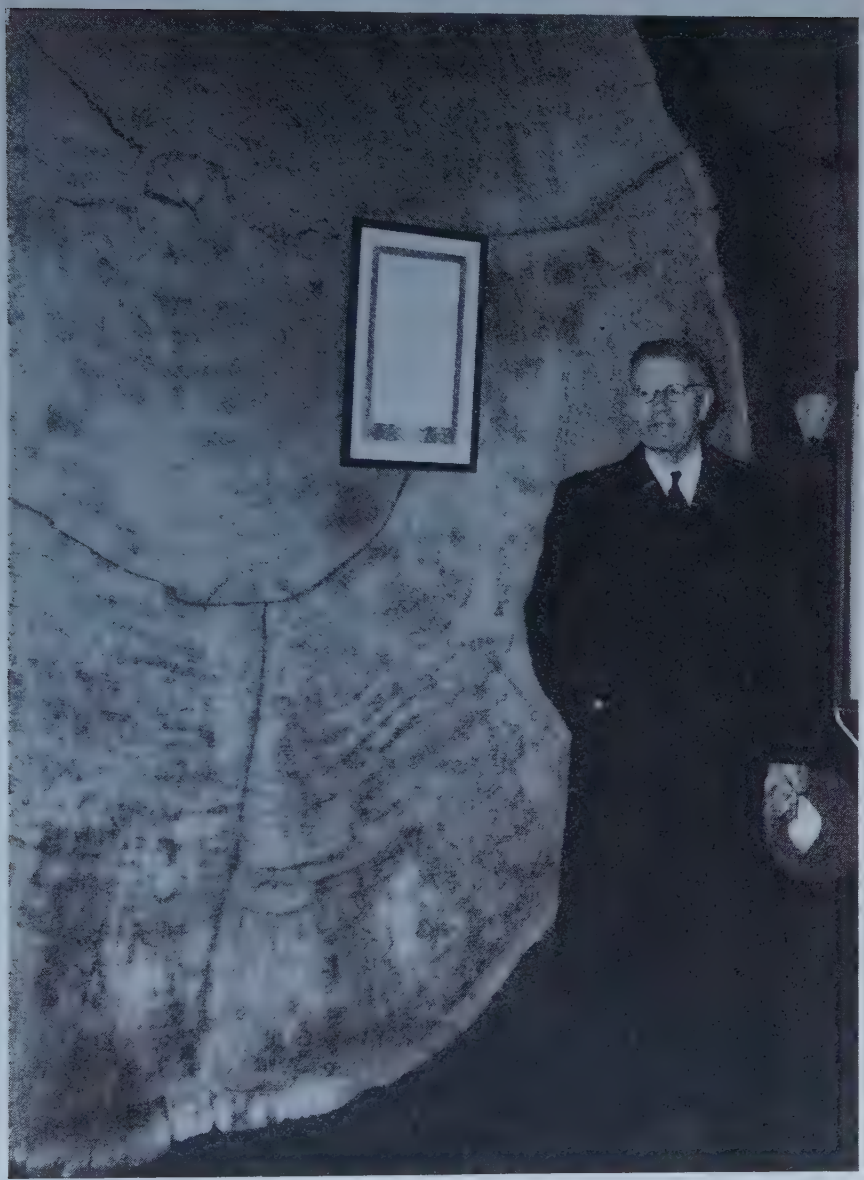


Fig. 3. Den i Riksmuseets botaniska avdelnings utställningssal monterade mammutträds-sektionen inspekteras av Hans Majestät Konungen d. $^{25}/_{1}$ 1954. — Foto E. Hultén.

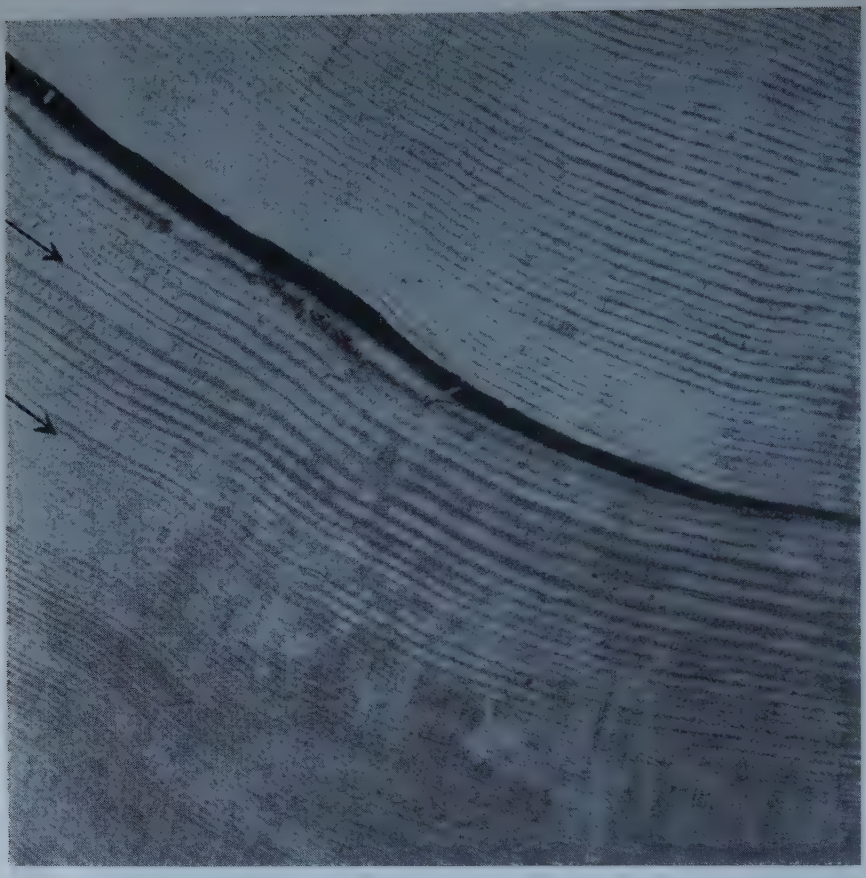


Fig. 4. Detalj av sektionen från tiden omkring Kristi födelse. Övre pilen utmärker årsringen 11 f. Kr., som är defekt på en del av sin omkrets och som därför lätt kan föranleda felräkning av antalet årsringar. Nedre pilen utmärker årsringen för vår tideräknings början. Omkr. $^3/_4$ av nat. storl. — Foto E. HULTÉN.

En absolut korrekt räkning av årsringarna är inte lätt, då en del äro mycket tunna och tättliggande. Det förekommer även, att vissa årsringar bli ofullständiga på någon del av sin omkrets. Räknas årsringarna utefter en bestämd radie, kan denna korsa en sådan årsring, där den är defekt och då icke blir räknad. Ett fel uppstår då. Detta gäller särskilt om årsringarna äro tunna och svåra att följa utåt sidorna från den radie man räknar på. Detta förhållande illustreras av detaljfotot fig. 4, där årsringen 11 f. Kr. visar sådan ofullständighet. Antalet årsringar är emellertid omkring 2 410. De äro i regel kraftiga i centrum men mycket tunna mot periferien, dock

finnas perioder med relativt tunna årsringar även från tiden strax efter vår tideräknings början, som framgår av fig. 4.

Åldern är större än man har rätt att vänta av stammens dimensioner. Trädet var redan vid vår tideräknings början en bjässe med över 1 ½ meters diameter och i sin bästa växtkraft på ALEXANDER DEN STORES tid. Det är ännu kärnfriskt till den första årsringen.

Utefter en radie på den monterade skivan ha knappnålar med röda huvuden instuckits för varje jämnt 100-tal år och nålar med gröna huvuden för de mellanliggande jämna femtiotalen. Utefter denna radie ha några märkliga historiska händelser under trädets liv markerats med följande rubriker:

Detta träd var 5 meter högt år 470 f. Kr.
PLATON föddes 429 f. Kr.
ALEXANDER DEN STORE regerade 336—323 f. Kr.
Puniska krigen började 264 f. Kr.
HANNIBALS tåg över Alperna 218 f. Kr.
Kartagos undergång 146 f. Kr.
CAESAR romersk ståthållare 68 f. Kr.
Vår tideräknings början. Kristi födelse.
Pompeji undergång 79.
HELIOGABALUS kejsare 218—222.
Kyrkomötet i Nicaea 325.
Västgoterna plundra Rom 410.
Romerska rikets fall 476.
Muhammedanska tideräkningens början 622.
KARL DEN STORE föddes 742.
ANSGAR i Birka 830.
LEIF ERIKSSON upptäckte Vinland 1000.
Lunds domkyrka invigdes 1145.
Stockholm grundlades omkring 1250.
Digerdöden 1350.
COLUMBUS upptäckte Amerika 1492.
GUSTAV VASA riksföreståndare 1521.
Slaget vid Lützen 1632.
KARL XII:s död 1718.
Mammutträden upptäcktes 1852.

På skivans andra sida har följande text anbragts:

Detta träd började växa 80 år efter slaget vid Marathon.
Vid Kristi födelse var det 470 år gammalt och en och en halv meter i diameter.
År 530 när Ynglingaätten regerade i Sverige var det 1 000 år gammalt.
År 1530 då GUSTAV VASA var konung, var det 2 000 år gammalt.
Det föll för stormen år 1940 och var då 2 410 år gammalt.

På skivan har upphängts den i två färger tryckta resolution, som tillställts oss från California Legislature, och där en redogörelse lämnas för denna gåva, dess tillkomst och överlämnande (fig. 5).

På pelaren bredvid sektionen har monterats ett stort fotografi av det största kända nu levande kaliforniska jätteträdet, som fått namnet »General Sherman».

För det intresse och det arbete som olika personer nedlagt på anskaffandet av detta ståtliga utställningsobjekt har Kungl. Vetenskapsakademien tilldelat följande personer sin större Linné-medalj i silver:

Honorable Earl Warren, Governor of the State of California,
Honorable De Witt Nelson, State Forester,
Honorable Ernest R. Geddes, Assemblyman of the State of California,
Dr Lyman Benson, Pomona College of the State of California.

Jag har genom korrespondens försökt att få närmare reda på de sektioner av kaliforniska jätteträd, som finnas utställda i europeiska och amerikanska museer. Resultatet redovisas här nedan.

Otvivelaktigt finnas även andra sektioner, som jag ej kunnat spåra upp.

Mammutträd:

American Museum of Natural History, New York: En sektion med 4,45 m diameter utom barken. Den härstammar från ett känt 84 m högt träd i Kings River Grove, Fresno County, som fått namnet »Mark Twain» och som fälldes år 1891. Skivan togs 6 meter ovan marken. Den delades i 12 delar för att underlätta transporten och har sedan skickligt monterats med bark i museet.

Ehuru dimensionen sålunda är något större än vår sektions, är åldern ej mer än 1 341 år, således föga mer än hälften av dennas.

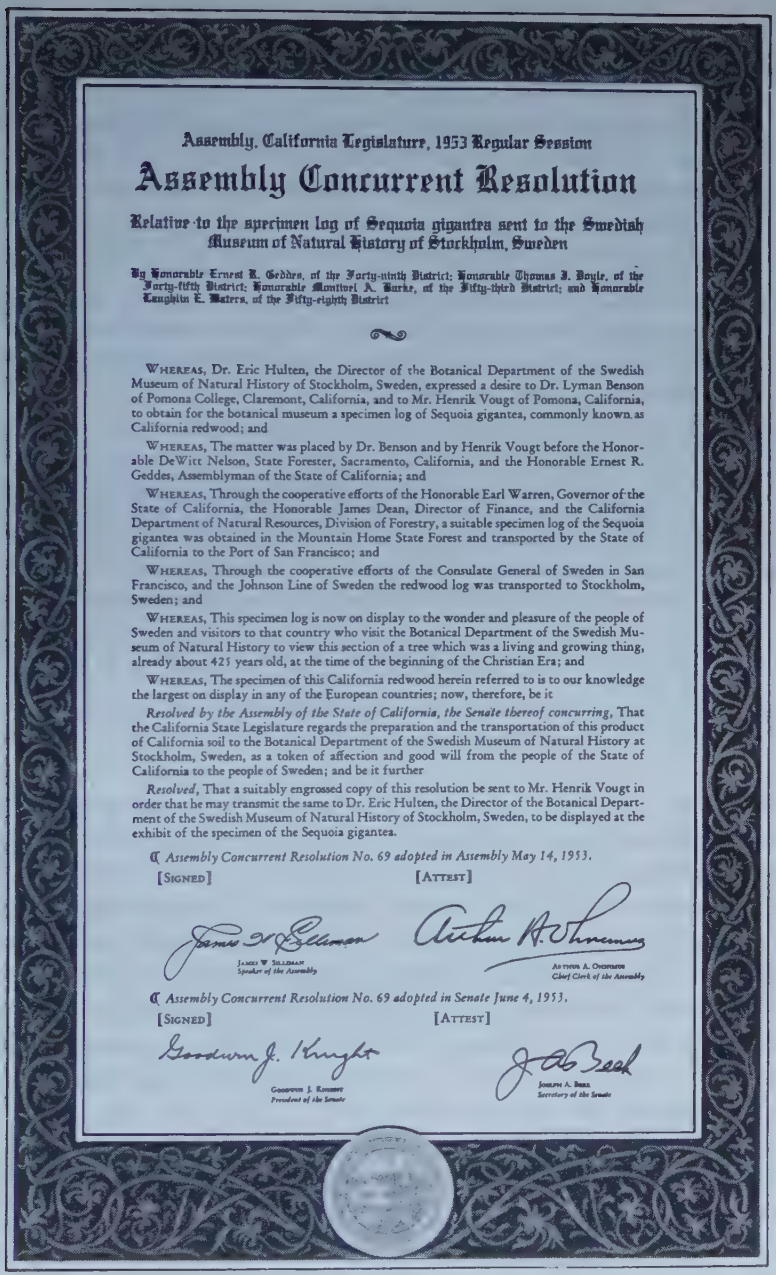
British Museum, London: En sektion av samma träd tagen omedelbart ovanför den här ovan nämnda och likaledes delad i 12 delar utställes i detta museum, där åldern anges till 1 335 år.

Royal Botanic Gardens, Kew: En skiva av samma träd.

Uppsala Universitets botaniska museum: En sektor av samma träd erhållen som gåva från British Museum.

Berlin-Dahlems botaniska museum: En sektor med 2,34 m radie och med en ålder av omkring 1 400 år. Obekant om den härstammar från samma träd.

Boston Museum of Science: En 30 cm tjock sektion 3—3,6 m i diameter och 2 048 år gammal. Trädet, från vilket denna sektion togs, fälldes 1952. Det var 73 m högt och hade en diameter av 5,5 m vid basen.



Assembly, California Legislature, 1953 Regular Session

Assembly Concurrent Resolution

Relative to the specimen log of Sequoia gigantea sent to the Swedish Museum of Natural History of Stockholm, Sweden

By Honorable Ernest R. Geddes, of the Forty-ninth District; Honorable Thomas J. Doyle, of the Forty-fifth District; Honorable Montivel A. Burke, of the Fifty-third District; and Honorable Caughlin E. Waters, of the Fifty-eighth District

WHEREAS, Dr. Eric Hulten, the Director of the Botanical Department of the Swedish Museum of Natural History of Stockholm, Sweden, expressed a desire to Dr. Lyman Benson of Pomona College, Claremont, California, and to Mr. Henrik Vougt of Pomona, California, to obtain for the botanical museum a specimen log of Sequoia gigantea, commonly known as California redwood; and

WHEREAS, The matter was placed by Dr. Benson and by Henrik Vougt before the Honorable DeWitt Nelson, State Forester, Sacramento, California, and the Honorable Ernest R. Geddes, Assemblyman of the State of California; and

WHEREAS, Through the cooperative efforts of the Honorable Earl Warren, Governor of the State of California, the Honorable James Dean, Director of Finance, and the California Department of Natural Resources, Division of Forestry, a suitable specimen log of the Sequoia gigantea was obtained in the Mountain Home State Forest and transported by the State of California to the Port of San Francisco; and

WHEREAS, Through the cooperative efforts of the Consulate General of Sweden in San Francisco, and the Johnson Line of Sweden the redwood log was transported to Stockholm, Sweden; and

WHEREAS, This specimen log is now on display to the wonder and pleasure of the people of Sweden and visitors to that country who visit the Botanical Department of the Swedish Museum of Natural History to view this section of a tree which was a living and growing thing, already about 425 years old, at the time of the beginning of the Christian Era; and

WHEREAS, The specimen of this California redwood herein referred to is to our knowledge the largest on display in any of the European countries; now, therefore, be it

Resolved by the Assembly of the State of California, the Senate thereof concurring, That the California State Legislature regards the preparation and the transportation of this product of California soil to the Botanical Department of the Swedish Museum of Natural History at Stockholm, Sweden, as a token of affection and good will from the people of the State of California to the people of Sweden; and be it further

Resolved, That a suitably engrossed copy of this resolution be sent to Mr. Henrik Vougt in order that he may transmit the same to Dr. Eric Hulten, the Director of the Botanical Department of the Swedish Museum of Natural History of Stockholm, Sweden, to be displayed at the exhibit of the specimen of the Sequoia gigantea.

Assembly Concurrent Resolution No. 69 adopted in Assembly May 14, 1953.

[SIGNED] [ATTEST]

JAMES W. SILLIMAN
Speaker of the Assembly

ARTHUR A. OHNIMUS
Chief Clerk of the Assembly

Assembly Concurrent Resolution No. 69 adopted in Senate June 4, 1953.

[SIGNED] [ATTEST]

GOODWIN J. KNIGHT
President of the Senate

JOSEPH A. BEEK
Secretary of the Senate

Fig. 5. Resolution från California Legislature rörande gåvan av mammutträds-sektionen. Däri föreskrives, att denna resolution skall utställas tillsammans med gåvan.

California Academy of Science, Golden Gate Park, San Francisco: En sektion med en ålder av 1 710 år.

Mariposa Grove Museum: En sektor med 4,5 m diameter och 1 830 årsringar.

Arizona State Museum, Tucson: En sektion 3 m i diameter med 1 704 årsringar.

Yosemite Museum, Yosemite National Park: En oval sektion 2,1 × 2,7 m, 996 år gammal.

Oslo, Universitetets Geologiske Museum och Botanisk Museum: Ett par ca 1 300 år gamla sektioner.

Stockholms Högskolas Geokronologiska Institut: En sektion, som institutets framlidne föreståndare prof. G. De Geer erhållit som gåva av Mr Robert W. Bliss. Den är 2 1/2 m i diameter och tagen 20 m över marken. Åldern är 1 633 år.

Coast Redwood:

Richardson Grove, State Park, Dyerville, Kalifornien: En 2 200 år gammal sektion. Detta är den högsta kända åldern för *Sequoia sempervirens.*

Humboldt Redwood State Park, Kalifornien: En sektion 3,65 m i diameter och 1 204 år gammal.

Museum of Science and Industry, Chicago: En sektion 2,4 m i diameter och 1 384 år gammal.

American Forestry Association, Washington: En sektion 3,6 m i diameter. 800 år gammal.

California Academy of Science, Golden Gate Park, San Francisco: En mindre sektion. Ålder okänd.

De kaliforniska jätteträden tillhöra som bekant två ganska olika arter: Redwood eller Coast Redwood, för vilka det latinska namnet *Sequoia sempervirens* allmänt brukas, och mammutträdet eller Sierra Redwood, som länge brukat benämnas *Sequoia gigantea.*

Sequoia sempervirens upptäcktes redan år 1769 av spanjorer, som kallade det »palo-colorado», det röda trädet, och sågs och insamlades av den berömde botanisten Menzies år 1794, medan dess motsvarighet i Sierra Nevada sågs första gången av en vit man så sent som 1852 i Calaveras Grove i Calaveras County. De sista bestånden blevo kända så sent som på 1890-talet.

Sequoia sempervirens bildar mäktiga skogar i ett smalt, upp till 6 mil brett band något innanför kaliforniska kusten från allra sydligaste Oregon på 40° till ungefär 38° n. lat. (strax norr om San Francisco) och fortsätter söder därom till 36° n. br. med några avbrott, så att fyra större från varandra åtskilda skogsområden bildas där. Bandets längd är ungefär 72 mil, och Sequoian är det dominerande trädet inom detta bälte.

I motsats till mammutträdet slår *Sequoia sempervirens* rotskott från stubbar och avsågade rothalsdelar. Vedknölar, som lätt driva ut skott, försäljas i souvenirbutikerna i San Francisco. Virket är mycket användbart, och stora avverkningar ha ägt rum. Starka krafter ha dock varit i verksamhet för att skydda dessa praktfulla och imponerande skogar och lämna dem i arv till kommande generationer. Sålunda har en enda organisation, »Save-the-Redwood-League», inköpt och skyddat 55 000 acres (2 200 hektar), bevuxna med redwood, till en kostnad av omkring 10 millioner dollar.

Sequoia sempervirens blir betydligt högre än mammutträdet, vilket icke överstiger 90 meter i höjd. Flera träd över 105 m höga och med en tjocklek av upp till 6 m äro kända. Det högsta av alla är ett 110,5 m högt träd i Humboldt Redwood State Park som av »Save-the-Redwood-League» erhållit namnet »Founder's Tree». Detta anges på en bronsplatta fäst på stammen vara världens högsta träd.

Man ser ofta uppgifter om betydligt högre *Eucalyptus*-träd i Australien. Det synes också troligt, att högre *Eucalyptus*-träd funnits där förr, men det högsta säkert uppmätta exemplaret anses vara ett 105,5 m högt träd av *Eucalyptus regnans* vid Colac i Victoria, som levde ännu år 1888 men som nu ej finns kvar. A. D. Hardy uppger i en uppsats, »Australian great trees» (1935), att det högsta nu levande *Eucalyptus*-trädet, »Cumberland Tree», är 91,5 m högt. Det mäter något över 5 m i diameter. *Eucalyptus globulus* uppnår liknande dimensioner i Tasmanien.

Ett pris på 100 pund har utlovats till den som kan ge anvisning på ett 400 fot (121 m) högt träd, men intet tillnärmelsevis så högt har kunnat anges.

Även Douglasgranen *(Pseudotsuga mucronata)* uppges nå över 100 m i höjd. Ett exemplar, som fälldes år 1895 i Seymour Valley, Vancouver, British Columbia, uppges ha varit 125,7 m högt och 7,6 m i diameter. Douglasgranar med sådana dimensioner synas icke existera numera.

Tills vidare får man alltså anse, att »Founder's Tree» har höjdrekordet bland jordens träd.

Åldern på *Sequoia sempervirens*-träden har länge ansetts ej överstiga 1 400 år, men på senare tid ha flera avsevärt äldre träd konstaterats. Det äldsta kända är det i Richardson Grove, State Park, Dyerville, utställda, som har 2 200 årsringar.

Mammutträdets botaniska namn är ej så lätt att riktigt ange. Till helt nyligen, 1939, har det förenats med *Sequoia sempervirens* un-

der släktet *Sequoia*, och namnet har brukat anges som *Sequoia gigantea*. En amerikansk forskare, J. T. Buchholtz, har emellertid i Amer. Journ. of Botany 26 (1929) p. 536 publicerat en uppsats, i vilken han gör gällande, att mammutträdet utgör ett eget släkte, väl skilt från släktet *Sequoia*, och man måste nog ge honom rätt. Skillnaderna äro avsevärda. Hos mammutträdet behöva kottarna två år för att ge mogna frön, de förbli gröna och sitta kvar på trädet många år efter frömognaden, kottefjällen bära 2 serier av 3—12 fröämnen och frön. Hjärtbladen variera mellan tre och fem. Knopparna äro nakna, bladen av ett slag, »juniperoida». Motsvarande karaktärer hos *Sequoia sempervirens* äro: kottarna mogna på ett år, bli bruna och fälla sina frön vid frömognaden, kottefjällen bära en enkel rad av 2—7 fröämnen, hjärtbladen äro vanligen två, knopparna äro fjälliga, bladen av två slag, små fjällika på de terminala skotten, stora skaftade på de övriga. Därtill komma betydande embryologiska skillnader. Intet av de släktnamn, som föreslagits för mammutträdet — *Cordylocarpus* Salisb. ej Desf., *Steinhauera* Presl, *Sequoia* Endl., *Wellingtonia* Lindl. ej Meisner, *Taxodium* Rich., *Washingtonia* Winsl. ej Wedl., *Gigantabies* Nelson eller *Athrotaxis* Baillon ej Don — blir användbart efter nuvarande internationella nomenklaturregler, och Buchholtz föreslår därför ett nytt namn, *Sequoiadendron*, med artnamnet *gigantea*.

Nyligen har emellertid professor H. St. John, Honolulu, påpekat, att i en liten katalog med okänd författare, som beskriver en utställning i New York, där en sektion av mammutträdet visades år 1854, släktnamnet *Americus* föreslagits. Den okände författaren tyckte, att *Wellingtonia*, som trädet då kallades, ej var passande för ett amerikanskt träd, då det syftade på en engelsk krigshjälte. Även om man numera icke godkänner sådana skäl för en namnändring, är publikationen gjord på ett sådant sätt, att man efter nuvarande regler ej kan vägra att beakta den (jfr Taxon, Vol. III, No. 1 [1954] p. 14), och mammutträdets namn skulle därför vara *Americus gigantea* (Lindl.) Anon. Nu föreslås i nämnda artikel, att släktnamnet *Sequoiadendron* skall upptas på listan över *nomina conservanda* vid nästa botaniska kongress i Paris och att mammutträdets namn alltså skall bli *Sequoiadendron gigantea* (Lindl.) Buchholtz. Det får anses troligt, att kongressen i Paris kommer att godkänna detta förslag.

Mammutträdet intar en vida mindre areal än *Sequoia sempervirens*. Den sträcker sig från något norr om knät på Kaliforniens

östra gräns vid 39° n. lat. omkring 40 mil mot sydöst på mellan 1 500 och 2 500 meters höjd på Sierra Nevadas västra sluttningar till omkring 36° n. lat. I den norra delen av detta område finnas dock endast få vitt skilda små bestånd, »groves», medan huvuddelen av beståndet återfinnes i den södra delen mellan 36° och 37° n. lat. Man brukar räkna med sammanlagt 32 sådana »groves» på sammanlagt 36 600 acres (14 800 hektar), och hela beståndet har uppskattats till cirka 76 000 större träd, varav 3 600 växa i norra delen av området.

Antalet verkliga jätteträd, som det varav vi nu ha en sektion på Riksmuseet, torde ej överstiga 500.

Stora delar av de ännu ej av avverkning rörda skogarna sakna ännu vägar och äro endast tillgängliga till fots.

År 1868, sexton år efter upptäckten, började man avverka mammuträden, men 1873 utfärdades en lag, som förbjöd avverkning av träd med större diameter än 16 fot (4,9 m). Brott mot denna lag ha ofta förekommit, men inga åtal synas ha väckts.

Redan år 1864 överläts Mariposa Grove till kaliforniska staten på tillskyndan av Abraham Lincoln. Efter många besvärligheter avsattes 1890 Sequoia-, General Grant- och Yosemite-parkerna, och 1906 återgav Kalifornien Mariposa Grove till U. S. A., för att den skulle ingå i Yosemite National Park. Aktioner för att skydda mammutträdskogarna ha sedan avlöst varandra, och i dag är 88 % av allt med mammutträd bevuxet land, eller 12 640 hektar, i statens ägo mot 1 770 hektar, som äro privatägda. Kaliforniska staten har just satt i gång en aktion för att inköpa och rädda vad som är värt att rädda även av denna ännu privatägda del. Under tiden har 34 % av mammutträdarealen hunnit avverkas, medan 66 %, eller 9 520 hektar, ej ännu äro rörda av yxan. Av denna sistnämnda del äger staten 92 %. Då kaliforniska staten går in för att bevara dessa praktfulla skogar för framtiden, är det sålunda numera ingen risk för att de skola skövlas.

Mammutträdet har ett grunt rotsystem och saknar huvudrot. De största, oftast besökta jätteträden lida av den hårda sammanpackning av jorden som uppstår genom trampningen runt dem, och man har börjat skydda dem mot denna fara. De ha en förhållandevis liten krona, men vinden torde ändå vara den största fara som hotar dem. Den tjocka barken skyddar dem mot eld och antibiotiska substanser mot insektangrepp. Blixten dödar dem ej. Den antänder ofta kronan, men träden överleva katastrofen. Man kan ej komma åt att

släcka elden så högt upp, utan man får nöja sig med att vakta den tills den slocknat av sig själv eller genom regn.

Föryngringen är god, men ungplantor fordra solljus för att växa till. I skuggan komma de ej till sin rätta utveckling. Virket är mindre användbart än virket av *Sequoia sempervirens*. Det är oerhört motståndskraftigt mot förruttnelse, tack vare garvämnen och antibiotiska ämnen, men saknar nästan hartsämnen och brinner dåligt. Det är dessutom sprött. Det har brukat användas till staketstolpar eller till stöd för vinet i vingårdarna, men dessa brytas lätt, och man har funnit att det blir dyrbart att ersätta de avbrutna, särskilt som de gå sönder om de slås ned och det blir betydligt dyrare att gräva ned dem. Till utvändig panelning av byggnader har virket även använts, men numera anser man det mindre lämpligt även därtill. Till bord och bänkar på verandor lämpar det sig utmärkt. Numera har dock virket sin största användning till takspån. Virkets sprödhet belyses av att man kan se korta, tvärt avbrutna jättestammar av mammutträd här och var i de större floderna inom området. Sådana avbrutna stammar av *Sequoia sempervirens*, vars virke är betydligt segare, ser man aldrig.

Förr fälldes träden med handsåg och yxa, och ofta lades snittet så högt som 3—5 meter över marken för att man skulle undgå den starkt förtjockade basala delen vid sågningen. Sprängning med krut var även vanlig, men det är nu förbjudet, då stammen oftast slås fullständigt i bitar i fallet. Numera använder man maskindrivna kedjesågar, och stubbarna få ej bli mer än några decimeter höga, då stora virkesmängder annars gå till spillo. Stammen styckas sedan upp i längder med kedjesågar, men grenarna sprängas fortfarande bort med krut. De avsågade längderna klyvas med stora kilar monterade på traktorer. En annan metod är att dela stockarna i halvor och fjärdedelar med hjälp av maskindrivna kedjesågar; härigenom vinnes att nästan intet av virket går till spillo. Åtminstone vid äldre avverkningar räknade man med att endast hälften av virket kom till nytta, medan resten splittrades alltför starkt. Nu göres takspån av sådana splittror.

De allra största jättarna av mammutträden ligga nu på marken och äro mer eller mindre förstörda (jfr fig. 6), antingen skadade av eld på ena sidan eller ihåliga. Det kanske allra största trädet höggs år 1853 i Calaveras Big Tree Grove. Det var 91 m högt och 29 m i omkrets. Diametern två meter över marken utom barken var 7 $^1/_2$ m, barken var cirka 4 dm tjock. På stubben gjordes en danspaviljong,

Fig. 6. »The fallen monarch» i Mariposa Grove. Diameter 3 m från basen 4,7 m. — Foto E. Hultén 1932.

där 32 personer kunde dansa, och om musiken medräknades, fick 49 personer rum i den.

Ett exemplar med en diameter av 8 ½ m blåste ned år 1855 men har sedan försvunnit, troligen har det brunnit upp.

Ett annat numera fallet och genom eld urholkat exemplar i Calaveras Grove, »Father of the Forest», är 8 m i diameter 2 ½ m från roten, 6,3 m 3 m från roten och 3 ½ m 30 m från roten.

Man har beräknat, att medeltillväxten är en tum på 20 år eller 0,127 cm pr år. »Father of the Forest» borde då vara omkring 6 480 år, men då den fälldes visade den sig vara endast 1 300 år. Dess årsringar voro alltså i medeltal 0,62 cm. Man får således akta sig att tro, att de största träden äro de äldsta. Ett träd, som var 3,55 m i diameter, exempelvis, befanns vara 2 019 år (medeltillväxt 0,18 cm pr år), medan ett annat, 7,30 m i diameter, blott var 1 346 år (medeltillväxt 0,55 cm pr år). Vårt träd har tillvuxit med i medeltal 0,16 cm pr år. Medeltalet av de första 300 årens tillväxt var 0,35 cm pr år, medan medeltalet av de 300 sista årens blott var 0,08 cm pr år.

Ett annat av de allra största träden är »Mother of the Forest». År 1854 togs barken av detta träd för att utställas i Östern, och trädet dog givetvis. Trädet var 97 m högt, omkrets vid basen med bark

27 m, utan bark 25 m, 6 m från roten 21 m, 21 m från roten 13 ½ m och 35 m från roten 12 m.

Barken monterades upp så att ett rum bildades inuti densamma. Den vandrade runt på olika utställningar och hamnade slutligen på Sydenham Crystal Palace i England, där den brann upp i slutet av 1800-talet.

Det största nu levande mammutträdet synes vara det som 1865 döptes till »General Sherman» i Sequoia Park. Det är 82 ½ m högt och 8 ½ m i diameter. Omkretsen är 33 ⅓ m, och vikten beräknas till 8 172 ton. Åldern är okänd. Ett annat av de allra största, »Grizzly Giant», hade jag tillfälle att fotografera vid mitt besök i Mariposa Grove 1932 (fig. 7).

Tabell I. Några av de största nu levande mammutträdens dimensioner.

Namn och plats	Höjd, m	Diameter vid basen, m	Diameter 3 m från basen, m
General Sherman, Sequoia Park (nyligen kontrollmätt)	82,5	9,3	7,3
Boole Tree, Converse Basin (troligen för höga siffror)	—	11,0	7,8
General Grant, Grant Park (nyligen kontrollmätt)	80,0	10,1	7,3
Washington, Mariposa Grove	71,0	8,8	6,3
Grizzly Giant, „ „	62,0	10,5	6,0
Columbia, „ „	90,0	7,8	5,0
South Carolina, „ „	80,5	7,1	5,3
Forest Queen, „ „	66,0	5,2	3,7

Åldern på mogna träd anses vara 400—1 500 år, och medelåldern på de allra äldsta, där årsringarna ha räknats, är omkring 2 250 år. Den största ålder, som med säkerhet är känd för ett mammutträd, är 3 148 år. Detta träd finnes i Converse Basin i Sequoia National Forest.

C. P. Huntingdon, den man som skänkte sektionen av »Mark Twain» till American Museum of Natural History, räknade 79 träd med över 2 000 årsringar, men han kände blott tre med över 3 000 ringar.

Några borrprov för att utröna de nu levande jätteträdens ålder synas aldrig ha gjorts, ehuru det är uppenbart att uttagandet av en

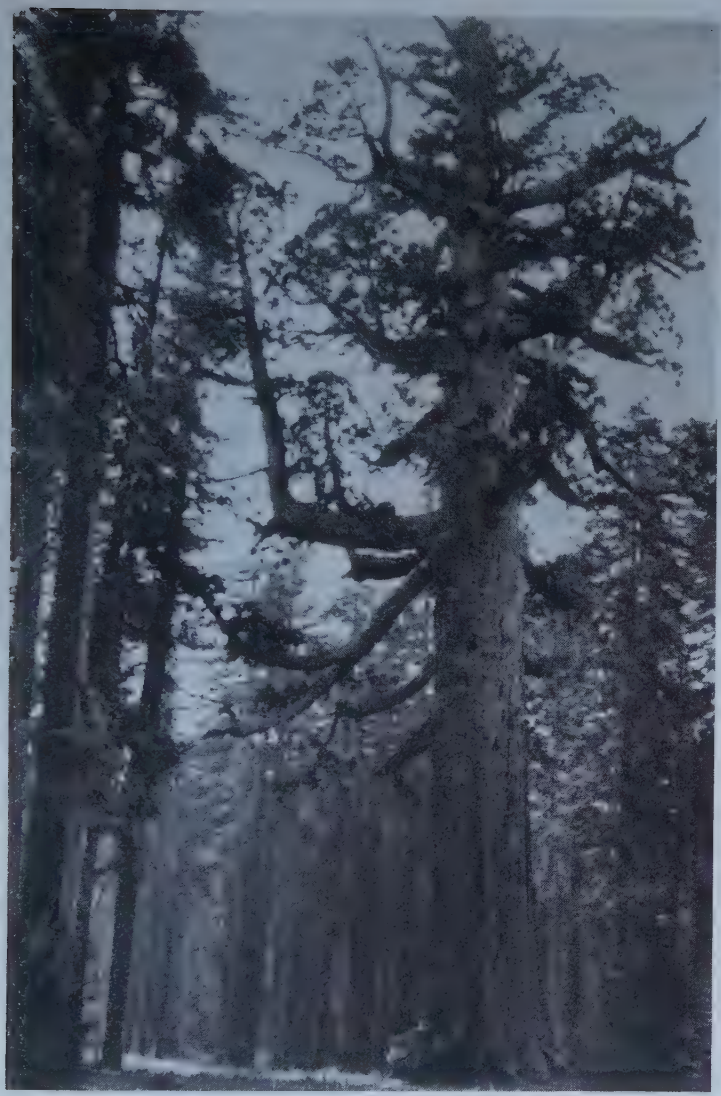


Fig. 7. »Grizzly Giant» i Mariposa Grove, ett av de allra största mammutträden. Höjd 62 m. Stammens diameter 3 meter ovan basen 6 meter. — Foto E. Hultén 1932.

sådan borrkärna icke skulle skada trädet. En speciell borr för detta ändamål finge givetvis förfärdigas, om sådana prov skulle tagas.

Riksmuseets mammutträdsektion tillhör tydligen den största storleksklassen och med ännu större säkerhet den äldsta åldersklassen. Den synes vara den äldsta som finnes monterad i något museum.

De kaliforniska mammutträden äro jordens äldsta och även största levande väsen. På den plats, där de nu växa, funnos de redan under tertiärtiden för millioner år sedan. De ha troligen vuxit där under hela den ofantliga tidrymd som förflutit sedan dess. De inge oss en känsla av urtid och odödlighet, och vi måste betrakta dem med eftertanke, undran och vördnad.

Summary.

Section of a 2400-year-old Sequoia tree for the collections of the Museum of Natural History, Stockholm.

A 2 ft. thick section of a mammoth tree about 2410 years old with a diameter of 3.66 m has been received as a gift from the State of California. The tree from which it was taken grew in Mt. Home Forest, Tulare Co., 1950 m above sea level, Sierra Nevada, California, and blew down in 1940.

A resolution passed by the Californian Legislature and accompanying the section states that it was presented by the people of California to the people of Sweden as a token of affection and goodwill. It is now mounted in the Exhibition Hall of the Museum so that it can be studied from both sides. Notable events that have occurred during the lifetime of the tree are marked along a radius where red pinheads mark every even 100th year and green pinheads every 50th year between the one century and the next.

The tree was about 1.5 m thick at the time of the Birth of Christ and nearly 2000 years old when Columbus discovered America.

The Swedish Academy of Science awarded the following persons the Linnean Medal for their help in securing this fine specimen as an exhibit for the Museum: The Honorable Earl Warren, Governor of the State of California; The Honorable De Witt Nelson, State Forester; The Honorable Ernest R. Geddes, Assemblyman of the State of California, and Dr. Lyman Benson, Pomona College.

On p. 436 a review is given of the sections of Californian giant trees existing in other museums.

The dimensions of the Sequoias and other giant trees are discussed, and it transpires that the highest living tree in the world is probably a Coast Redwood 110.5 m high called "Founder's Tree" and growing in Humboldt Redwood State Park, California.

The existence of *Eucalyptus* trees or Douglas firs even taller than

this has been reported, but no specimens of such a height have actually been located.

The dimensions of the largest known mammoth trees are given on p. 444.

The scientific names of the Coast Redwood and the Sierra Redwood are discussed, also the nature and use of their wood and the average rate of growth. The Sierra Redwood is considered to belong to a separate genus, *Sequoiadendron*.

The oldest known mammoth tree has 3148 annual rings and is to be found in Converse Basin, Sequoia National Forest. The Coast Redwoods are usually much younger, rarely over 1400 years old. Exceptionally, a tree 2200 years old has been found. The specimen now on exhibition at the Museum of Natural History in Stockholm thus belongs to the oldest class, although trees twice as thick are known.

The Californian giant trees are the oldest and largest of living things. They were already growing in California in the Tertiary era, millions of years ago, and have probably been growing there ever since. They give us a feeling of primitive ages and of eternity, and we regard them with wonder and awe.

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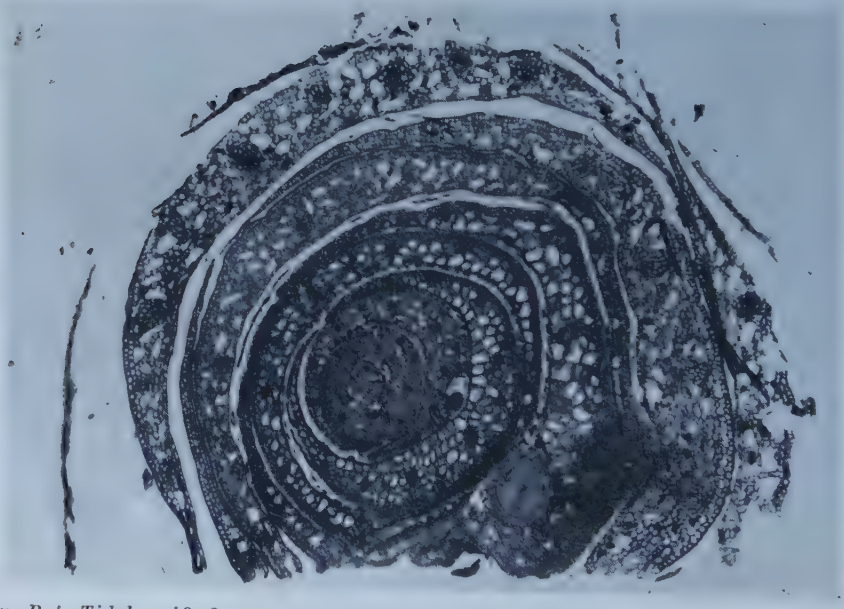

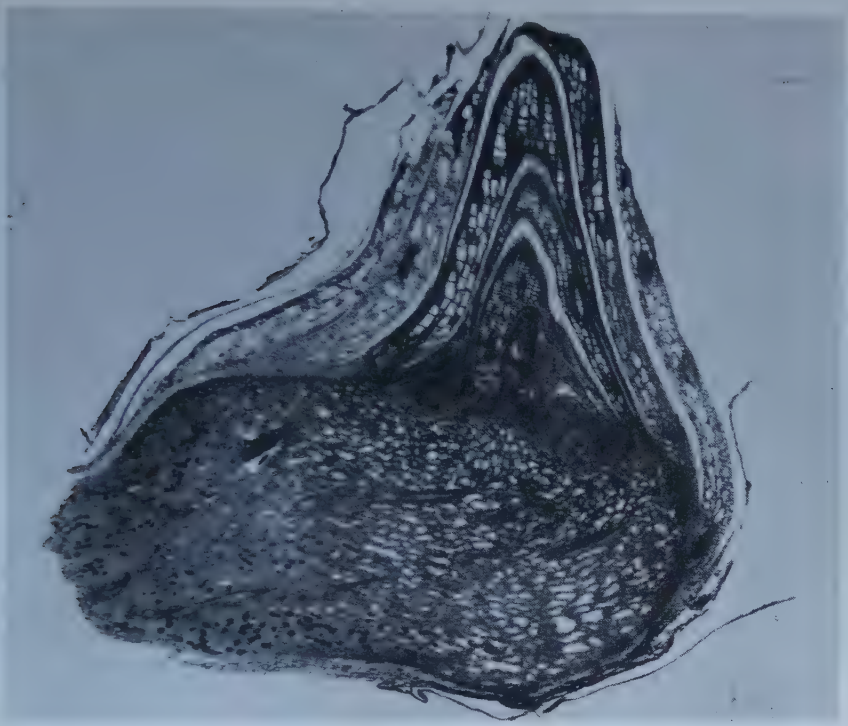

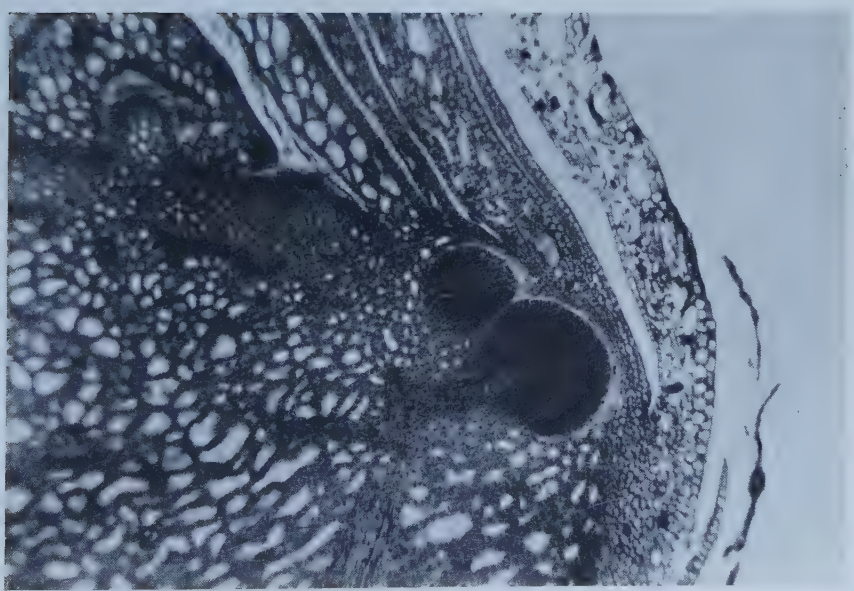

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THE APICAL EMBRYO- AND SHOOT-MERISTEM IN GNETUM, EPHEDRA AND OTHER GYMNOSPERMS.

BY

FOLKE FAGERLIND.

1. Introduction. The shoot apex in gymnosperms and angiosperms has been studied to a remarkable extent during the last decades. Leaving the peculiar behaviour during the leaf formation in the Gramineae and the first embryonal phases out of the question, tunica-corpus differentiated meristems seem to be the rule in the last-mentioned group. In most of the gymnosperms there are in the meristem apical cells which produce new tissue by anticlinal as well as by periclinal divisions. However, tunica-corpus differentiated meristems have been described in a few species. But in these, the periclinal divisions in the tunica are very rarely met with. Hence there are still some reminiscences of the more primitive meristem type.

The structure of the embryo- and shoot-apex in *Gnetum* has been studied by various authors (cf. Johnson 1950, 1951). Most of these descriptions are not very comprehensive, however. Bower (1882) was of the opinion that the dormant buds had what we now call a tunica. In the seedlings, however, there was frequently a solitary apical cell and periclinal divisions in exposed lateral cells. Haining (1920) observed a tunica in the apex, cotyledons and hypocotyl of the embryo. In the adult plants Johnson (1951) described a one-layered tunica mostly acting entirely in the correct manner. Periclinal division in the tunica occurred only during the formation of the foliar buttresses, and in one of the 85 cases studied somewhat higher on the flanks of the apical cone. In the apical part of that cone periclinal tunica divisions were entirely lacking.

According to Johnson (1950), the formation of tunica and corpus

is not the only result of the differentiation processes in the apical meristem of *Gnetum* — cf. Fig. 6 b. Beneath the high meristematic tunica apex — the "apical initials" — there is a group of "sub-apical initials". Periclinal and oblique divisions in its basal part create the underlying "central mother cells". Through divisions — mostly anticlinal — in the periphery of the sub-apicals and the central mother group the "flanking layers" of the meristem are formed. Chiefly through divisions, which produce new walls perpendicular to the axis of the shoot, the "pith rib meristem" is initiated in the base of the central mother group.

The meristem zones differ more or less vaguely from each other by the size and shape of their cells, by their plasma type and degree of vacuolation and by the orientation of the new-formed cell walls.

In *Ephedra* Gifford (1943) found the same conditions in principle as those described for *Gnetum* above. Only one periclinal division in the tunica was demonstrated in 70 shoot apices studied.

2. Material. My own investigation is based on the following material.

Species	Provenience	Object
Gnetum Schwackeanum Taubert	Belem, Pará, Brazil	Young embryos
Gnetum nodiflorum Brongn.	Rio Negro, Tungurahua, Ecuador	Old embryos, apices from seedlings and from adult shoots
Gnetum Gnemon L.	Hort. Bog., Bogor, Java, Indonesia	Young embryos, shoot apices from adults
Ephedra sp. 1	Chuqulpogyo, Chimborazo, Ecuador	Ditto
» » 2	Ambuqui, Imbabura, Ecuador	Ditto

The material was collected by the author during a journey financed by "A. F. Regnells botaniska gåfvomedelsfond" and "Wahlbergs Forskningsfond" and by "Naturvetenskapliga forskningsrådet" (The Swedish Natural Science Research Council).

3. The undisturbed primary meristem pattern. Some time after fertilization a number of proembryos are to be found in *Gnetum* (Fig. 1 *a*) and *Ephedra* (cf. Schnarf 1933, Fagerlind 1941, Johansen 1950). Each of these is composed of a tubular basal part — the primary suspensor — and an apical cell (Fig. 1 *a*—*b*). Later

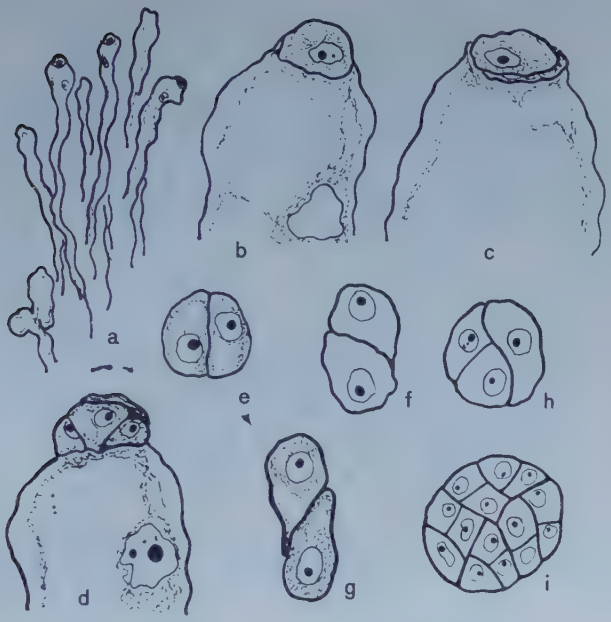

Fig. 1. *Gnetum Schwackeanum*. *a*. Proembryonal tubes. *b*. The apex of a proembryonal tube with tube nucleus and apical cell (= the definitive embryo). *c-i*. The embryo during earlier developmental phases. — *a-d* longitudinal section, *c-i* transverse sections.

the apical cell, which constitutes the definitive embryo during its one-celled stage, divides. The new wall is perpendicular to the basal wall of the mother cell. Each of the two new-formed sister cells is more or less like a quarter of a sphere in shape (Fig. 1 *c*, *e*) or — instead of this — the shape is as illustrated in Fig. 1 *f* *g*. The shape is very likely a consequence of the limited space in the endosperm.

The two sisters divide more or (Fig. 1 *h*) less synchronously through walls perpendicular to the old ones. The result is a cell quartette (Fig. 1 *d*), whose members are remarkably similar in shape. They are separated from each other by four walls — the quadrant walls. These form a central cross.

Gnetum Schwackeanum is a favourable object for studying the next steps in the continual development. In *Gnetum gnemon* the very young embryos are embedded in the endosperm in such a way as to render the studies more difficult. It is quite impossible to get distinctly oriented sections. In contrast to this, it is not very difficult to obtain approximatively transverse sections in the first-mentioned species. These sections and some of the longitudinal ones show a

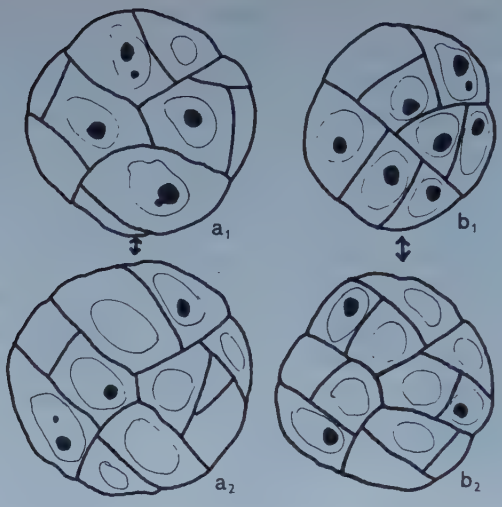

Fig. 2. *Gnetum Schwackeanum*. The pattern in two different (a_1-a_2, b_1-b_2) embryo apices. — a_1 and b_1 transverse tangential sections, a_2 and b_2 the following sections in the same series.

rather distinct arrangement of the cells. These longitudinal sections are in my opinion approximative tangents to one or two of the quadrant walls.

Transverse sections, which are at the same time tangents to the actual embryo apex, show the following construction.

The centre is occupied in almost exactly the same degree by four cells (Figs. 1 *i*, 2). Hence there is a central wall-system cross. The latter varies only slightly in its shape. The variations are exemplified in Fig. 2. The variation may perhaps be wholly or partially a consequence of the shape of the apical group during its two-celled phase or of the space limitation during the later development.

Each of the four apical cells is separated from a "segment" of two or three more peripherally and more basally situated cells by oblique, curved walls in a manner illustrated in Fig. 2. By studying whole series of transverse sections we find that the oblique walls recur several times in a regular manner but that there are also some wall systems running diagonally through the squares formed by the first-mentioned oblique walls. There is certainly a definitive synchronism scheme; the synchronism is not absolute, however.

Very often the longitudinal sections believed to be quadrant wall tangents have a more or less pronounced bilateral pattern (Fig. 3), built up by the different cells. It is possible to find a right-hand and

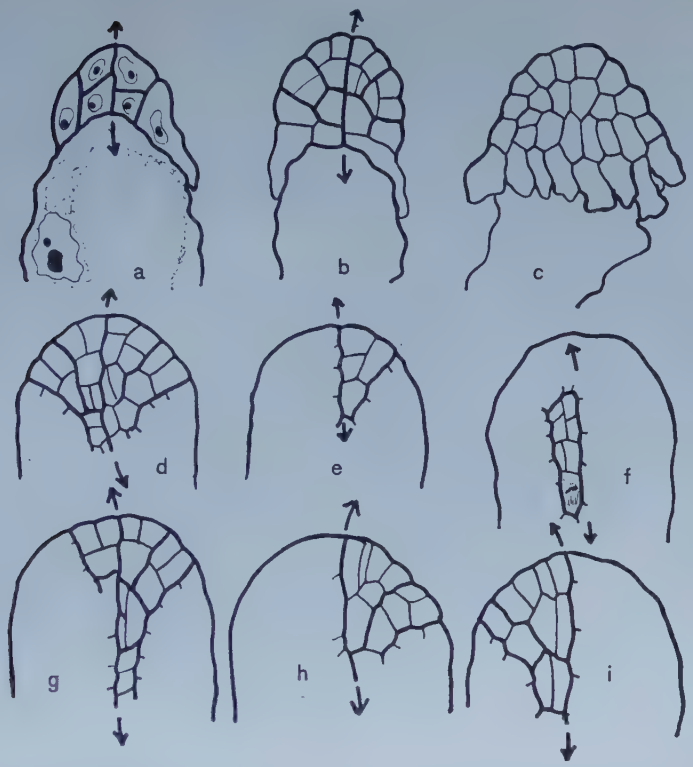

Fig. 3. *Gnetum Schwackeanum.* The embryo during earlier developmental phases. *a-b, d-i* longitudinal sections, *c* tangential, longitudinal section. — *a-g* show more cr less the undisturbed pattern; in *h* and *i* there is a slight disturbance caused by the commencement of the rounding off processes.
The figures are partially schematic; because of the three-dimensional system it is impossible to make an entirely correct illustration. — The arrows denote the attempted embryo axis.

a left-hand pattern, which are more or less distinctly the reflected images of each other. In each half there is an apically placed cell in intimate contact with the embryo axis. Each of these has an exposed and more peripherally placed sister cell. On both sides of the axis very often the sisters are basally followed by a cell — the basal cell — whose anticlines are a direct continuation of the embryo axis and the external anticlines of the sister pair. Hence the two sisters and the corresponding basal cell must be the result of successive divisions started in one and the same mother cell. Sometimes it is possible to detect on the exterior side of the last-mentioned group another group of almost the same shape (Fig. 3 *d, g –i*).

These two groups have their "floor" in one and the same plane; the whole floor-system is at the same time the "roof" of a cell block with rather smooth contours.

The "transverse and the longitudinal figures" combined with each other show that the meristem is "quartette initiated", that the cell divisions in a series of successive initial quartette cells are continuing in various different ways which are recapitulated in conformity with a definitive schedule.

The only possibility of getting an undoubtedly correct reconstruction of the processes is to put together all the pictures from whole series of very thin transverse sections of very actively dividing apices. I have not been supplied with such material and indeed there may well be no possibilities of obtaining material that is dividing actively in the necessary degree. However, the "landmarks" I have mentioned above or pictured — Figs. 1—3 — give rise to the following attempt at reconstruction. Its deviation from the real conditions cannot be very great.

Each cell in the primary quartette has the following four walls; the curved external wall, the basal wall which is in common with the primary suspensor and continuous with the other cells in the quartette, and the two quadrant walls, which are in common with the neighbouring cells in the quartette. Each cell has of course six edges; the internal edge, which is in common with the two radial walls and also with all the radial walls in the remaining quartette cells, the two basal radial edges and the peripheral edge, which borders the basal wall, and the two upper radial edges, which together with the peripheral edge border the external wall.

During one of the cell division types, which recur in conformity with the rhythm scheme, each cell in the quartette is more or less synchronously divided into a new quartette cell, which occupies the same position as the mother cell, and a more peripherally and more basally placed sister cell. The new wall "cuts" the external wall, one of the quadrant walls and the basal with curved lines. The intersection line with the first wall divides the peripheral edge approximately into equal parts and extends down to the peripheral edge, which is divided quite heterogeneously — cf. Fig. 4. The intersection line with the second wall is also a downwards running curve, the one in the basal wall, if regarded from the central axis of the embryo, being a convex arc. The quadrant wall, which is cut by the new wall in one of the mother cells, is also cut by the new

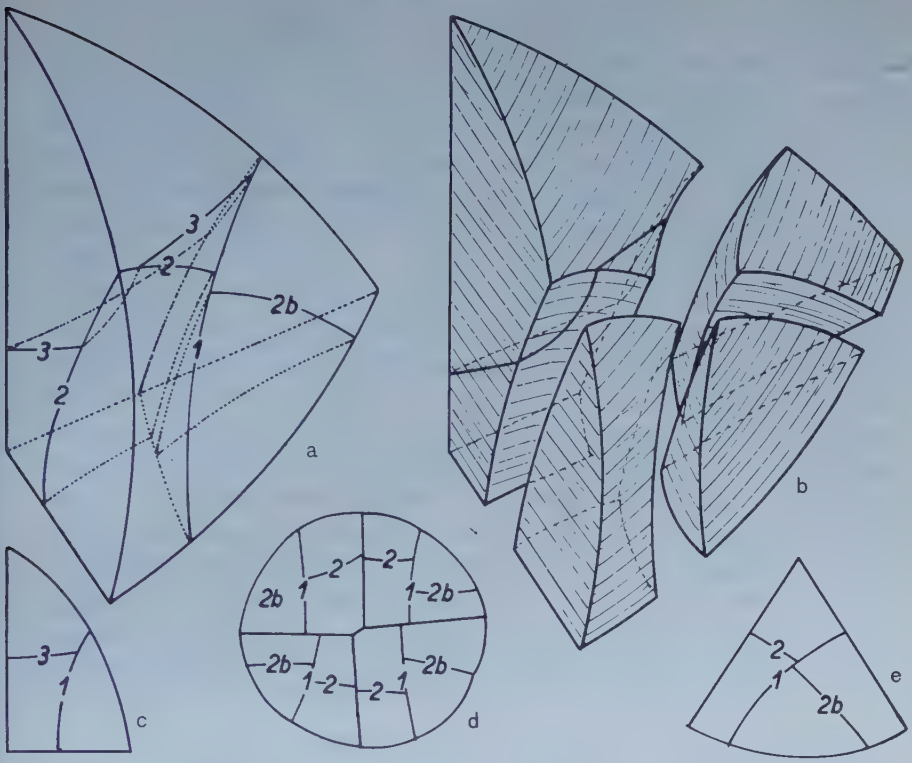

Fig. 4. Attempted reconstruction of the wall system in the apex of the young embryo. *a*. The three-dimensional system in one of the quadrants. *b*. Ditto; some of the cells are moved aside in order to make the picture clearer. *c*. The intersection lines in the quadrant wall. *d*. Ditto, in the basal wall system of the whole quartette. *e*. Ditto, in the external wall.

wall in the close neighbour in the quartette; the one left in an intact state, is also left intact in the neighbour (Figs. 1 *i*, 2, 4 *d*).

The cells in the new-formed quartette have of course a new shape. They and their sisters divide in their turn. Now the new wall system (2 and 2 *b* in Fig. 4) is oriented in such a manner that they and the penultimate wall form an approximately symmetrical wall-system cross in each of the four quadrants.

The now existing apical quartette (Fig. 4 *a—b*) has an exposed apical part and a basal part, which is hidden by the more-celled segments created during the cell divisions mentioned just above. Compared with the earlier quartettes the height now predominates over the diameter. The following cell division represents a quite new type (Figs. 4 *a—b*, 5). The new wall (3 in Fig. 4 *a*) is slightly

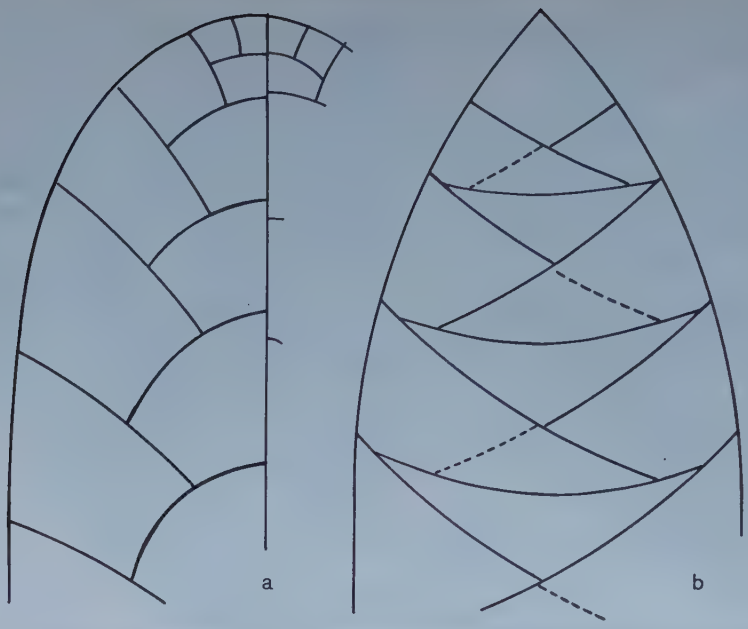

Fig. 5. Attempted reconstruction of the undisturbed primary pattern in the apical meristem. *a*. The pattern in the quadrant wall systems. *b*. Ditto, in the external wall systems (the dotted lines belong to the secondary pattern).

vaulted; it runs from a point at about the middle of the interior edge and cuts the two quadrant walls. It also cuts the walls last formed during the earlier quartette divisions as well as the external wall. After all the procedures now described, the now existing quartette cells have obtained a shape which is in principle the same as that occurring before the first-described division. The three divisions are now repeated, but follow a scheme that is the reflected image of the original schedule. The first new wall does not cut the same radial wall as it did during the first link in the foregoing three-phased division series; instead of this it cuts the one left intact on that occasion (Fig. 5 *b*).

If my reconstruction is correct, there must be a definitive rule for the wall orientation. The new wall is always a so-called "minimum surface" issuing from the youngest wall of the mother cell. Possibly this is only a consequence of a more general law, according to which the mitotic spindles are oriented in the same direction as the resultant of the components of the cell stretching forces which work in different directions. The same rules do in fact recur when it is a question of the solitary initiated meristems.

The cell wall system, which is the consequence of the divisions in the quartette cells, produces a pattern. It is appropriate to call it "the primary pattern" of the meristem. Because of processes in the more advanced embryo, possibly also occurring in the more advanced parts of the young embryo, it is also appropriate to speak about the undisturbed and the disturbed pattern.

An attempted reconstruction of the undisturbed primary pattern is illustrated in Fig. 5. The primary pattern shows that the embryo of *Gnetum* is composed of four quadrants (cf. Fagerlind 1946), each of which is a pure derivative of one of the original quartette cells. Hence it is possible to speak about quadrant walls and quadrant wall systems also in the more advanced embryo. The rhythmically repeated alternations in the pattern may possibly be correlated with other rhythmically repeated changes in the *Gnetum* plant; with the leaf decussation — cf. Fagerlind 1946.

The plant anatomists speak about anticlines and periclines. This way of speaking can also be applied to the primary pattern of the apical meristem of *Gnetum*. Nobody will misunderstand it. However, in reality it is wrong. All the walls are more or less arched, they all form angles with the mantle surface of the embryo.

4. The secondary pattern. The tissue successively created from the initial quartette has for a time a meristematic nature. Hence a secondary pattern is formed. Of course it will be still more difficult to make a reconstruction here. It is, however, possible to make a few observations serving as good "landmarks".

On the whole the flanking sister cells of the initials and the exposed cells descending directly or indirectly from these sister cells act for a time in approximately the same manner as the initials themselves (Fig. 3 *d*, *g—i*). After some plastochrones, however, they appear to chose a new mode of development. Before the meristematic capacity becomes extinct, tendencies to restrain the periclinal divisions seem to be at work. Instead of forming the walls running obliquely against the quadrant walls, the "older" exposed cells create perpendiculars and parallels.

Each of the basal cells — the basal daughters of the quartette initials — divides into an exposed, external cell and a quite unexposed one. The latter is called a central cell. The exposed cells so formed act exactly like the exposed derivatives of the flanking sisters in the apex.

In the level where the basal cells are new-divided the *Gnetum* body is composed by four undivided centrals and a whorl of exposed cells. Because of the following divisions each of these cells — the centrals as well as the exposed cells — is transformed into a multicellular block. Hence the more matured part of the body is composed by a central column built up by central blocks and a flanking mass built up by peripheral blocks. The blocks in the column following successively after each other, as well as those in the flanks, represent a successive scale of age.

The central cells are divided by means of curved walls, which are more or less parallel with the embryo axis. The new wall cuts only one of the quadrant walls. Hence in the longitudinal sections, which I consider to be quadrant wall tangents, the divided basal common to an initial and its lateral derivative sometimes appears to be divided, sometimes undivided (Fig. 3 *b*, *d—i*). The two daughters of the basal cell divide by means of "mirror walls". After this walls are formed perpendicular to the embryo axis.

According to the processes described above, the development scheme in the centrals is the same as that in the initials, but slightly modified. In the basal block now created and its later derivatives the same tendencies may possibly be conserved but there seems to be a proportionate enlargement of the number of the walls, which are perpendicular to the embryo axis. In the first place this is valid for the derivatives situated close to the axis. The other derivatives and all the tissue which is placed between them and the exposed layer, show transformations of the main scheme, which are intermediate between those in the exposed and in the most central part. The peripheral, subperipheral, cells etc., obtain at the same time a successively different cell shape, plasmatic appearance and so on. Thus, already in the meristem of the young embryo it is possible to discover a very diffuse but increasingly pronounced process of differentiation; the exposed layer and the succeeding layers are developed according to gradually changed but at each step only slightly changed schedules.

Based on Foster's (1943) studies in the cycads, Schüepp (1952) put forward a scheme valid for the shoot apex of the higher plants. This scheme shows an extreme conformity with the above description. The most fundamental difference is that he reckons with a solitary initiated one, whereas *Gnetum* and *Ephedra* — possibly all gymnosperms — have a quartette initiated one. The shape of the

cells in the different parts of the meristematic body is, according to SCHÜEPP, the consequence of their different position and, on that account, their different capacity to stretch themselves in different directions and in different degrees. The division law they are following and the successive transformation of these laws are likely to be conditioned in the same manner. Hence, we can discern a close co-operation between the location, shape, stretching of the cell and orientation of the mitotic spindle.

5. Illusory disturbances in the primary and the secondary pattern. In the more advanced embryos we only seldom discern the above described primary pattern — cf. Fig. 8 *a—f*; in the younger embryos this pattern will successively disappear in the basal part. In both cases this is in part the result of changes in the shape of the young cells. These cells and their corners show a more or less pronounced tendency to round themselves off and to assume smoother contours. It is absolutely sure that this process is in progress. It is not very difficult to pick out different figures (e.g. Figs. 3 *h—i*, 8 *a*, *d*) in the slides, which together represent the whole history of the transformation.

Nor is it very difficult to understand the reason for the successive disappearance of the original primary pattern in the actual apex of increasingly developed embryos. If the durability of the plastochrones in the more advanced embryos does not go hand in hand with a shortening of the rate of the rounding off process, the original pattern will of course disappear. The walls "corresponding" with each other in the original pattern will no longer do so in the same degree or at all. Also the quadrant wall system is subjected to the correspondance disturbances. Therefore in the slides it is not very easy or not possible at all to detect the quadrant walls and the central axis of the more advanced embryo — cf. Fig. 7. However, here and there in the more advanced embryo we still find fragments of the original pattern. This favours the opinion that the cell division scheme is still unaltered.

Because of the rounding off process disturbances a more or less diffuse border line not very far from the mantle surface of the meristem is created (Figs. 7 *b*, 8). A "pseudo-epidermis" composed of exposed adult cells and groups of new-formed cells wedged in between them is the consequence (Fig. 8). These cell groups are of course the result of one or a very few rapid divisions of an exposed

mother cell. The pseudo-epidermis is "broken" at only a very few points. The breaks betray its and their nature. They are the result of the growing out of the daughter cells, which have now attained their intermediate size and have not yet completed their rounding off process.

As already stated, the consequence of the rounding off process is that the anticlines in the pseudo-epidermis do not correspond to the anticlines in the following layer. Therefore in the slides the new border line shows a more or less serrate contour; the inner contour of the pseudo-epidermis is not as smooth as its exposed contour (Fig. 8). This inner contour is at the same time the external contour of the following layer. Through exactly the same processes which formed the pseudo-epidermis layers separated more and more diffusely from each other are created between the pseudo-epidermis and the axis. These processes and the successively more and more pronounced differences between the shape, plasmatic character and division type of the cells have as a consequence the successively less and less diffuse presentation not only of the superficial layer — the pseudo-epidermis — but also of a central column and an intermediately placed diffusely stratified "flanking layer".

According to my opinion this column is nothing but the column composed by the different central blocks (cf. Chapter 4); the superficial and the flanking layers are derivatives of the peripheral blocks. However, it is not possible to prove that this really is the case. It is also possible that the most pronounced interior border line corresponds to definitely placed lines inside the central or the flanking blocks.

6. Apparent disturbances in the primary pattern. The formation of the tunica-corpus differentiated meristem. From the time when the embryo has produced its cotyledons — also in the old embryos as well as in seedlings and in adults — it is possible to detect in the apical meristem processes deviating from those which earlier produced the undisturbed primary pattern. These processes seem to be the very same as those acting during a later phase in the formation of the secondary pattern. The tendencies to eliminate the periclinal divisions in the exposed cells, which were dealt with in Chapter 4, arise earlier and earlier in the increasingly aged embryos and finally the tendency is obvious as early as the initial quartette; that is, as early as during the formation of the primary pattern. When

the elimination was total in the quartette initial as well as in the other exposed cells, the quartette initiated meristem was from that time on transformed into a tunica-corpus differentiated meristem.

In *Gnetum* and *Ephedra* it is possible to study step by step the transformation from a regular quartette initiated meristem into a tunica-corpus differentiated one. The transformation is not quite complete, however. The old embryo still shows numerous periclinal divisions in the exposed cells of the apical part of the meristem. It is, however, not out of the question that the number of anticlines has increased to some extent. In the seedlings (Fig. 8 *b*—*c*) this increase is striking. In the adult the periclinal divisions are very rare. However, in my material of *Gnetum Schwackeanum*, *nodiflorum* and *gnemon* they are not as rare as JOHNSON described them to be in the last-mentioned species. They are not only present at the formation of the foliar buttresses and in the most peripheral part of the apical cone, but also in its actual apex. Therefore I have found more agreement with the statement of CROSS (1943) and KEMP (1943) for *Taxodiaceae* and *Torreya* than those of JOHNSON for *Gnetum gnemon*.

Already in the old embryo the anticlines predominate over the periclines not only in the peripheral layer but also sometimes in the base of the subapical part of the following mantle. If the formation of the periclines were totally suppressed in both these layers the result would be a meristem with a corpus and a two-layered tunica! More basally in the subperipheral layer the periclines are, however, coming back or possibly the development follows different schedules in the different radial planes. In the cotyledonary plant and in the adult the periclines are here occurring at approximately equal intervals — cf. the regular pattern illustrated in Fig. 8 *h*. Possibly the processes here are going on in conjunction with the formation of the undisturbed primary pattern. These conditions ought to be studied in greater detail.

From the very moment when the periclinal divisions in the quartette initial become very rare the whole tissue mass inside the epidermis — or pseudo-epidermis — is temporarily only a derivative of a subapical group. If my opinion — cf. Chapter 3 — about the daughter cell formation in the apical quartette is correct, the said subapical group is also a quartette. If my opinion about the daughter cell formation in the subapical quartette — cf. Chapter 4 — is also correct, not only the quartette initiated meristem but also the tunica-corpus differentiated one forms a shoot, composed of four equal

quadrants, each of which is a derivative of only one of the primary quartette cells.

The subapical quartette is totally or partially reconstructed every time a periclinal division occurs in the apical quartette. Such a very rarely occurring reconstruction of the corpus initials is the only way of explaining the fact that the angiosperm chimaeras sometimes produce shoots built up only by the epidermis producing part of the original chimaera.

7. The definitive zonation in the meristem. In the cotyledonary plant and still earlier, the apical meristem shows the diffuse zonation already described — cf. Chapter 5. In the adult the zonation becomes more distinct. The successively more accentuated elimination of the periclinal divisions in the pseudo-epidermis sharpens the incipient differentiation into a tunica with its own apical initials and a corpus with its own subapical initials. Parallel with the strengthening of this tendency the border line between the pseudo-epidermis (or epidermis) and the following layer becomes smoother and smoother. Parallel with this also the contours between the other diffuse layers become more or less pronounced. Hence the border between the flanking layers and the central column becomes successively more conspicuous. A further consequence is the creation and sharpening of a border between the highly meristematic subapical zone and the rest of the central column as well as of the flanking layers. As long as there are only anticlinal divisions in the apical initial zone the whole mass of the flanking layers and the central column is of course entirely a product of the subapical zone. The column tissue next to the subapical zone — the central mother cells — is still of a highly meristematic nature. The central mother cells or/and the underlying part of the column show characteristic transformations. Obviously the process has something to do with the external differentiations, resulting in the production of the leaf-bearing nodes and the internodes. At some levels the central column is very soon represented by more isodiametric, well vacuolated cells with only a very much reduced meristematic nature. The parts placed between these levels conserve their meristematic character for a long time. They very soon show the nature of a so-called rib meristem with mitotic spindles oriented parallel to the embryo axis.

The ribs of the rib meristem are highly meristematic in their central part, the meristematic capacity being successively lost in

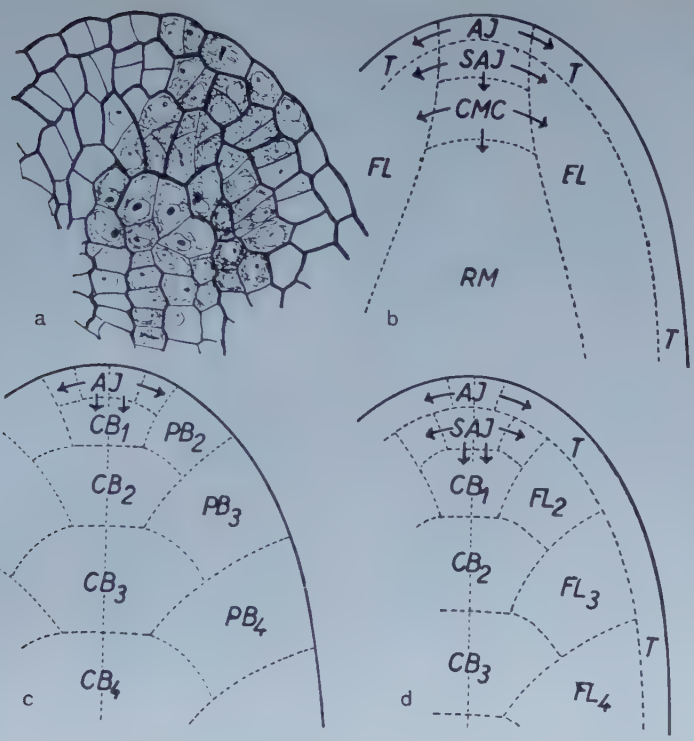

Fig. 6. *a. Gnetum gnemon.* Shoot apex of an adult plant. *b.* The meristem zones in *Gnetum* based on JOHNSON's paper of 1950. (AI = apical initials, SAI = subapical initials, CMC = central mother cells, RM = rib meristems, FL = flanking layers, T = tunica and epidermis.) *c-d.* Ditto, according to my opinion; *c.* quartette initiated meristem; *d*, tunica-corpus differentiated meristem (AI = apical quartette initials, SAI = subapical quartette initials, CB_1-CB_4 = central blocks of different age, PB_1-PB_4 = peripheral blocks of different age, FL_1-FL_4 = flanking blocks of different age, T = tunica and epidermis). — *Note.* The division of the basal cell into a peripheral and a central cell is not illustrated.

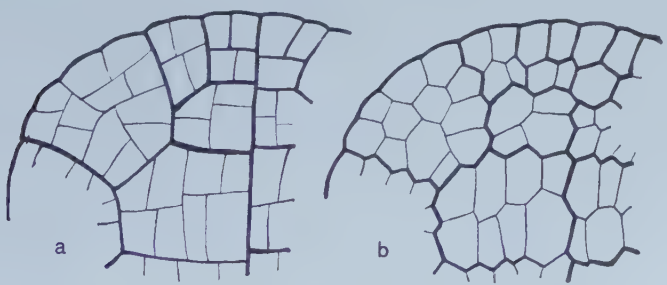

Fig. 7. Attempted reconstruction of the primary (with heavy lines) and secondary pattern: *a*, undisturbed; *b*, disturbed through the rounding-off processes. — *Note.* The *b*-figure is the direct result if the cells in the *a*-figure are slightly rounded off.

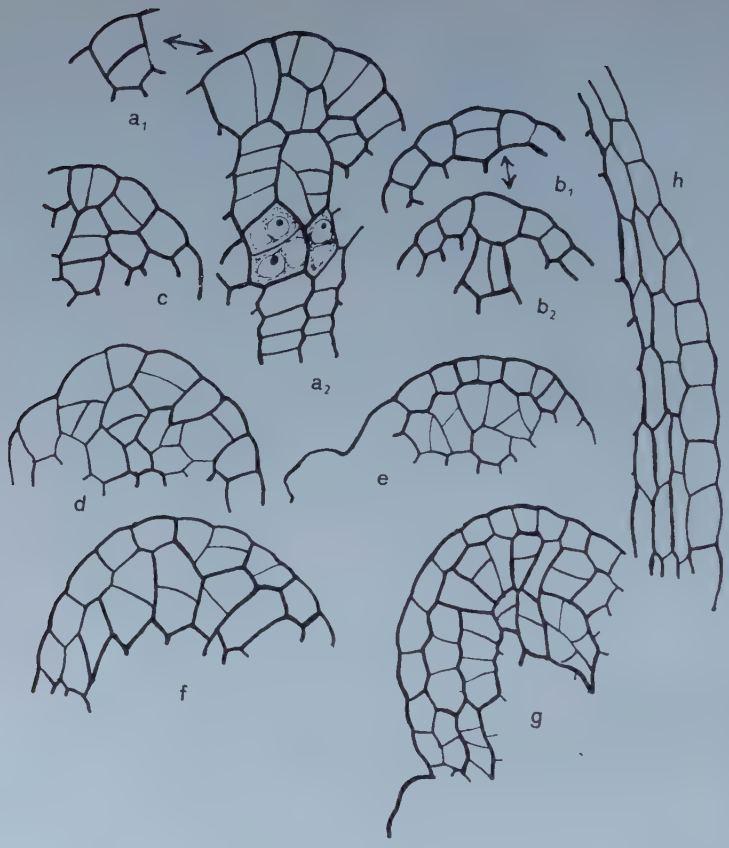

Fig. 8. *Gnetum nodiflorum. a-f.* Epicotyl apices of older embryos. *g.* Primary apex of an adult plant. *h.* The subepidermal layers and the epidermis on the lateral side of a seedling; longitudinal section parallel to the surface of the first leaves of the epicotyl.

both of their ends. Hence the highly vacuolated tissues grow successively in both their poles by means of the incorporation of maturing cells produced by the intermingled rib meristems.

The first appearance of the vacuolated cells high up in the apical meristem is likely to be the result of the following process. The cells in the central mother zone soon assume the rib meristematic character. This means that they produce two equal daughter cells separated by an anticline. These and their later derivatives repeat the process. The capacity for creating daughther cells is more pronounced in the middle of the ribs so created. The end cells become mature. The cells which first mature become the victims of the rounding off process. Thus the first vacuolated cells detected in the

meristem apex are nothing but the end cells in the underlying, at first more irregular, ribs (Figs. 6 *a*, 8 *a*). The cells which mature later seem very distinctly to be members of the ribs even after a few plastochrones. This is possibly because of a successive transformation of the relation between the duration of the plastochrones and the rate of the rounding off process and of a successive strengthening of regularity in the construction of the ribs.

According to the description above, the primary group with vacuolated cells, the following zones built up of vacuolated cells and the intermingled rib meristems are not the result of a real zonation but of the successive maturation of the young tissue in accordance with a quite definitive scheme. The zonation of the meristem is often least well marked in the strongly developing shoots, most well marked in the slightly active and in the dormant buds and shoot apices. In these we very often get the incorrect impression of a real tunica — cf. the opinion of BOWER — and not seldom that there is also a second tunica layer. Very often we find vacuolated cells instead of the ordinary central mother cells — cf. the statement of JOHNSON. The reason is not difficult to understand. The plastochrones are now long. Hence the cells placed in contact with each other very often represent unusual degrees of maturity well separated from each other. Thus we do not find the whole transformation chain from strongly meristematic subapical initials, unvacuolated central mother cells, vacuolated cells and so on to cells which have partially "matured" into rib meristem initials, rib meristem members, or vacuolated cells, all of which represent the rib meristem during different developmental phases.

The meristem zones distinguished — the apical initials, the subapical initials, the central mother cells, the flanking layers, the rib meristem and so on — are not at all, or at least not always, the result of a tissue differentiation process in the ordinary sense. Most of them are the result of the passing of characteristic phases in the development during periods when the cells in question are placed in approximatively distinct parts of the meristem.

In Fig. 6 *b—d* the differences between JOHNSON's and my own opinion about the zonation of the meristem are illustrated. According to my opinion his SAI (subapical initials), CMC (central mother cells) and RM (rib meristems) are roughly nothing but my central blocks of different age. The cells placed most apically in his SAI are however the same as my basal cells and, a little later, my central

cells, which really act as subapical initials in the tunica corpus differentiated meristem. Of course the differences between our opinions are due to the difficulties in observing the real borders of the cellular blocks of different sequence — cf. page 460.

In accordance with the terminology of BUDER (1928) — and later of KORODY (1937) — the quartette initiated *Gnetum* body should be called a naked corpus. This way of looking at it has been criticized by FOSTER (1939). Because of the similarities in the development of the apical initials into a quartette initiated body and the subapical initials into a corpus, reasons for following BUDER's opinion are not quite lacking. However it would then be necessary to define the terms in a very unpractical way.

8. The earlier phases in the development of the leaf, the axillary bud, the ovule and the nucellus. Deviations from the "tunica-corpus rules" are sometimes met with during the foundation of the leaves — cf. JOHNSON's statement to that effect — and the axillary buds. Before the formation of the first leaf, very seldom in the primary but more often in the secondary member in the bud series in one and the same axil, fragments of the typical undisturbed primary and secondary patterns can be detected (Fig. 9 *c—f*). In a few cases the "epidermal" apex is also included (Fig. 9 *g*).

In the apex of the very young leaf, in the apex of the undifferentiated ovule and in the top of the young nucellus (cf. STRASBURGER 1879, KARSTEN 1893, FAGERLIND 1941) there are also phenomena corresponding to these in the shoot apex. The tunica-corpus differentiation is more or less defective in their apices, but in contrast to this the more peripheral parts show an almost complete elimination of the periclinal divisions in the exposed cells in the following zone before they assume the meristematic character.

9. Ephedra and Welwitschia compared with Gnetum. The statements above are primarily based on the studies in *Gnetum*. In *Ephedra* my studies were not very comprehensive. However, they show nothing — cf. GIFFORD 1943 — which deviates in principle from the *Gnetum* conditions.

Possibly the same is also the case in *Welwitschia*. RODIN (1953) writes about the shoot apex in this genus: "A surface layer of cells results from anticlinal divisions of the apical initials. The surface layer is rather discrete, but occasionally a periclinal division occurs

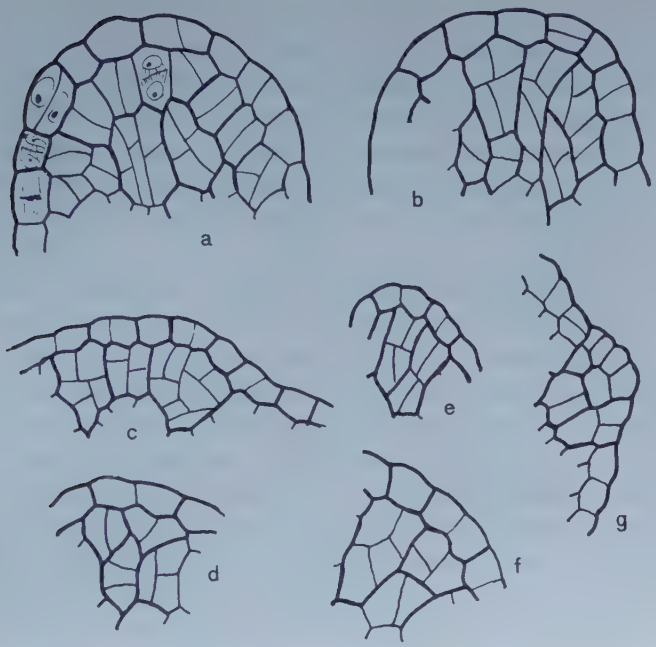

Fig. 9. *Gnetum nodiflorum*. *a-b*. Primary apices of adult plants. *c-g*. Apices of very young axillary buds of adult plants.

in it. . . . The shoot apex does not have a complete discrete surface layer of cells resembling in this respect most gymnosperms, but differing from *Gnetum* and *Ephedra*." However, it is not right to neglect the fact that *Welwitschia* ceases its development very early — only the cotyledons and the first pair of leaves are formed. During the corresponding phases of development periclinal divisions are still rather frequent also in *Gnetum* and *Ephedra*.

10. The other gymnosperms compared with Gnetum. The reports about the apical shoot meristem in the gymnosperms are summed up by Johnson (1951). This summary and the results of my study show that only a few and in principle insignificant differences exist inside the gymnosperm group. Most gymnosperms have no tendency at all, or only a slight one, for the elimination of the periclinal divisions in the exposed cells; others — *Araucaria* (Strasburger 1872, Griffith 1950, 1952), *Cryptomeria* (Cross 1941), *Sciadopitys* ? (Strasburger 1872), *Taxodium* (Cross 1939), *Ephedra* and *Gnetum* — have this tendency more or quite strongly pronounced

at least during the adult stage. Another difference is that the borders between the apical initials, the subapical initials, the central mother cells, the rib meristems and the flanking layers (or the different blocks) are diffuse in different degrees. In *Cycadaceae* (Foster 1939 *b*, 1940, 1941 *a*, 1943, Johnson 1939, 1944 *a*, 1944 *b*) and *Pseudotsuga* (Sterling 1946) it seems to be possible to detect all or most of the said zones, in *Ginkgo* (Foster 1938) the superficial and the subapical initiation zones cannot be separated from each other, in most *Pinaceae* (Foster 1939 *b*, Korody 1937), in *Araucariaceae* (Griffith 1950, 1952), *Taxodiaceae* (Cross 1939) and (*Taxaceae* (Kemp 1943) it is not possible to detect the central mother cells.

The comparison gives the impression that the differences are more quantitative than qualitative. Hence it is not out of the question — but of course not proved — that the "definitive" embryo in the gymnosperms always has a meristem with very few initials (a quartette initiated meristem ?) and that the meristem and its initials work in accordance with the scheme described above. If this opinion is correct the gymnosperm shoot is built up of four or of a few equal tissue cords, running parallel with each other and placed in a whorl; each one of those tissue cords is produced by its own apically placed initial cell. If the tunica-corpus differentiated meristem is formed the tunica as well as the corpus in each of the tissue cords is produced by its own apical initial. These two initials are directly or indirectly daughter derivatives of one and the same mother cell placed earlier in the actual apex of the existing cord. Indeed, this opinion corresponds very well with my previously published ideas (Fagerlind 1946) about the shoot of the higher plants. In a future paper I shall return to these problems and analyse them in greater detail.

Summary.

In *Gnetum* and *Ephedra* a quartette of equal cells lying in one and the same plane perpendicular to the tube axis is found in the apex of the proembryo. Observed facts and the intuitive filling up of the gaps in the observation series result in the following ideas about the fate of the primary quartette and its derivatives:

(1) Quartette cells in the apex of the young embryo and their derivatives divide themselves according to a regular scheme. Anticlinal as well as periclinal divisions occur. An attempted reconstruction of the scheme is illustrated in Figs. 4—5.

(2) According to the division scheme the quartette initial in question is always a daughter product of a penultimative quartette; all the successive quartettes lead more or less indirectly to the original one.

(3) The periclinal divisions of the exposed cells are later more or less eliminated. The elimination process will at last assume such proportions that a tunica-corpus differentiated meristem is practically the result.

(4) According to the division scheme the whole *Gnetum* embryo and the more or less adult *Gnetum* plant are composed, both before and after the formation of the tunica-corpus differentiated meristem, of four equal quadrants, each of which is entirely a product of the corresponding cell in the original initial quartette.

There are no indications of differences in principle in the apical meristem of the embryo or of the adult shoot in the gymnosperms. The tendency of transforming the original meristem type into a tunica-corpus differentiated one is, however, pronounced only in *Gnetum, Ephedra* and a few other genera.

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SOME REMARKS ON TERMS, DIAGNOSES, CLASSIFICATION, AND METHODS IN PALYNOLOGY.

BY

G. ERDTMAN.

Palynology — terminological remarks.

The term palynology coined by Hyde and Williams ten years ago, means pollen and spore science. This term is much wider than the terms pollen analysis, pollen statistics, spore analysis, etc. It is, therefore, hardly adequate to use, as has sometimes been done, the term palynology in the sense implied by the latter terms. The same applies to the use of the term pollen analysis in matters entirely outside the pollen analysis in the original von Postian sense of the word.

"Een palynologisch onderzoek naar de menselijke invloed op de plantengroi van de diluviale gronden in Nederland" is, in point of fact, a pollen-analytical — or pollen-statistical — investigation. "Eine pollenanalytische Untersuchung von Honigproben", on the other hand, should preferably be referred to as a "melito-palynological" investigation. In a "pollen-analytical" study of *Pyrus communis* it is the morphology, fertility, etc. of the pollen grains that is dealt with.

Photomicrographs and palynograms.

In descriptions of pollen grains and spores photomicrographs are often of great value (cf. Fig. 1, left-hand figure), although, for technical reasons, they are sometimes rather misleading (cf. Fig. 1, right-hand figure: the small hexagonals have no counterpart in reality).

An ideal palynogram is a diagrammatic but at the same time detailed and penetrating representation of a pollen grain or spore, its

symmetry, apertures, shape, size, sporoderm stratification, patterns, etc. It demonstrates — with inevitable shortcomings — the pollen grains as they are perceived by the microscopist. About 600 palynograms of angiospermous plants have been published in "Pollen Morphology and Plant Taxonomy. Part I" (Almqvist and Wiksell, Stockholm 1952). A number of palynograms of pollen grains and spores in gymnosperms (Pl. I and II, Figs. 2—5), ferns (Figs. 6—8), and mosses (Fig. 9), which will be included in the forthcoming second part of that book, are herewith published with the permission of the publishers.

Pl. I and II and Figs. 2—5 (sacciferous gymnosperm pollen grains) have been reproduced from india ink drawings into which small

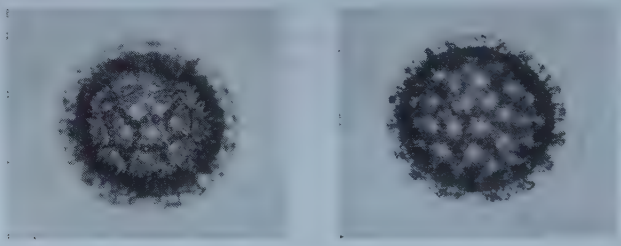


Fig. 1. *Tribulus cistoides*. Left-hand figure: surface; right-hand figure: optical section ×400. — From SELLING, Studies in Hawaiian pollen statistics. II. Göteborg 1947.

photomicrographic squares were inserted. These insertions proved necessary since no draughtsman can possibly render with complete accuracy the subtle details of these pollen grains. Whenever several photo squares have been inserted into a drawing of a saccus or a 'corpus', they exhibit successive sexine patterns — at high (= uppermost, or extreme left-hand square), medium, and low (= lowermost, or extreme right-hand square) adjustments of the microscope. Photomicrographs at the margin of the sacci convey an idea of the length, mode of branching etc., of the intruding 'rods'.

In some photomicrographs — cf., e.g., the uppermost squares in the sacci in *Keteleeria davidiana* (Pl. II) and *Pseudolarix kaempferi* (Fig. 4) — small black dots are visible. They seem to represent small holes (puncta) in the walls of the sacci. Cf. further Pl. I, C (*Abies mariesii*) and the electron micrograph in Pl. IV (part of section through a saccus in *Cedrus deodara*).

Palynograms of representatives of the Marattiaceae are coordinated in Fig. 6. Some species have trilete spores (detail figures A—

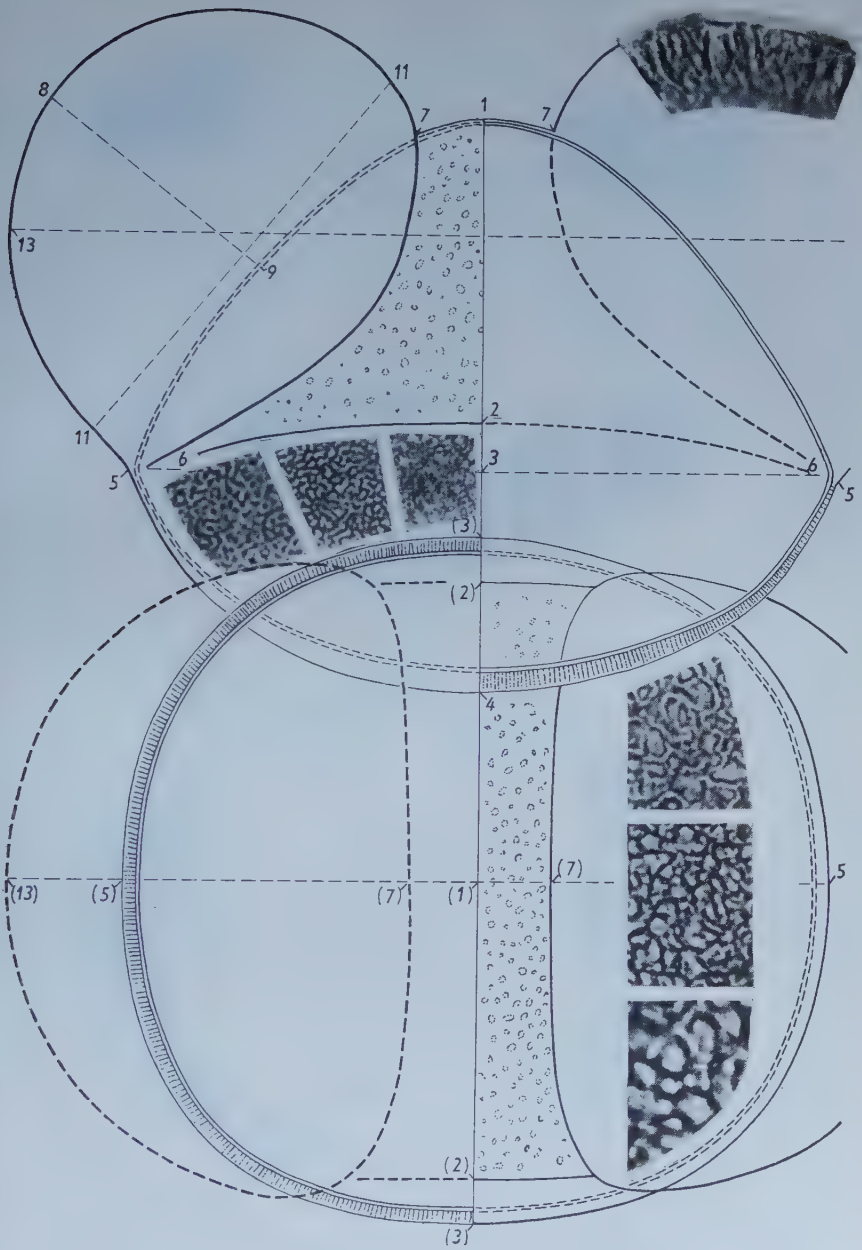


Fig. 2. *Picea hondoensis.* Palynogram. For explanation, cf. Pl. I. ×1000.

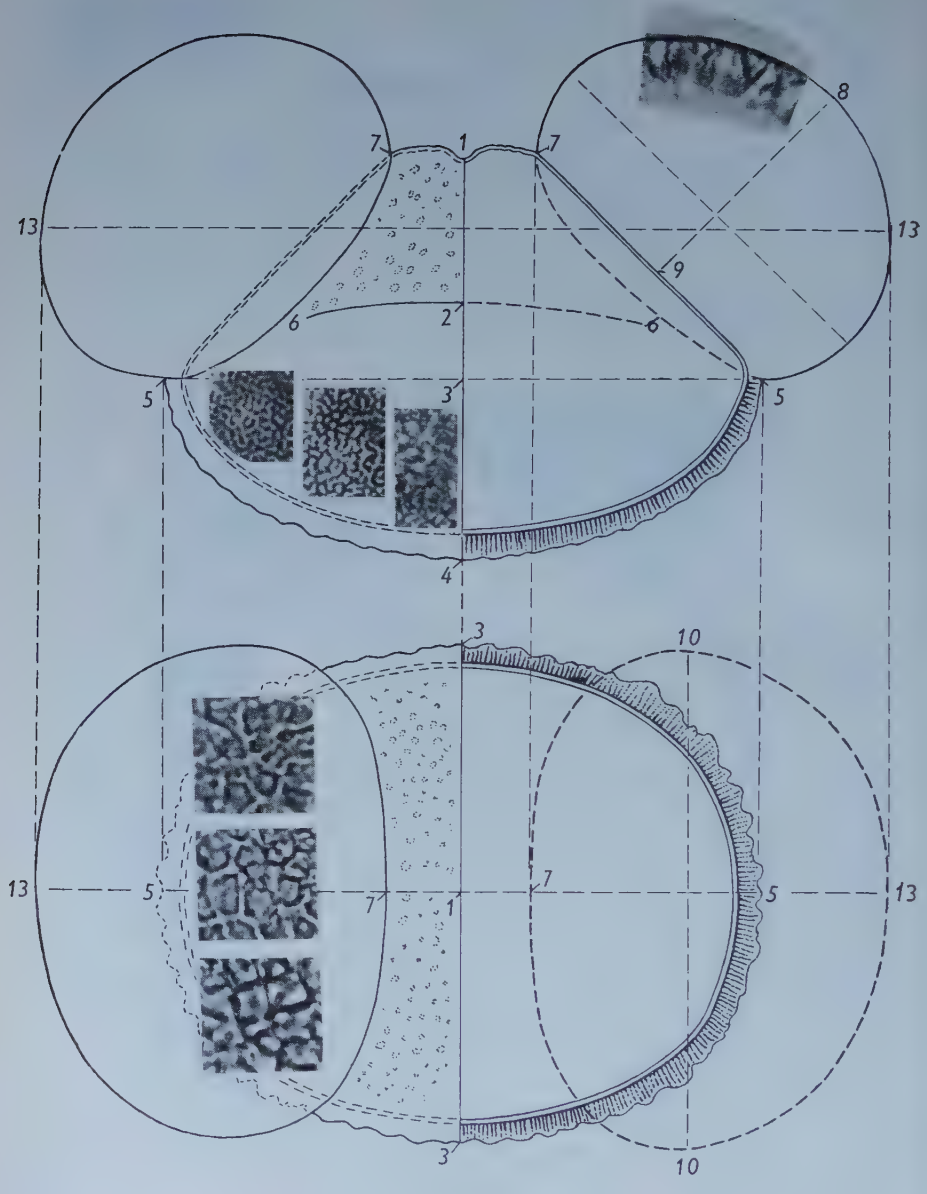


Fig. 3. *Pinus excelsa*. Palynogram. For explanation, cf. Pl. I. ×1000.

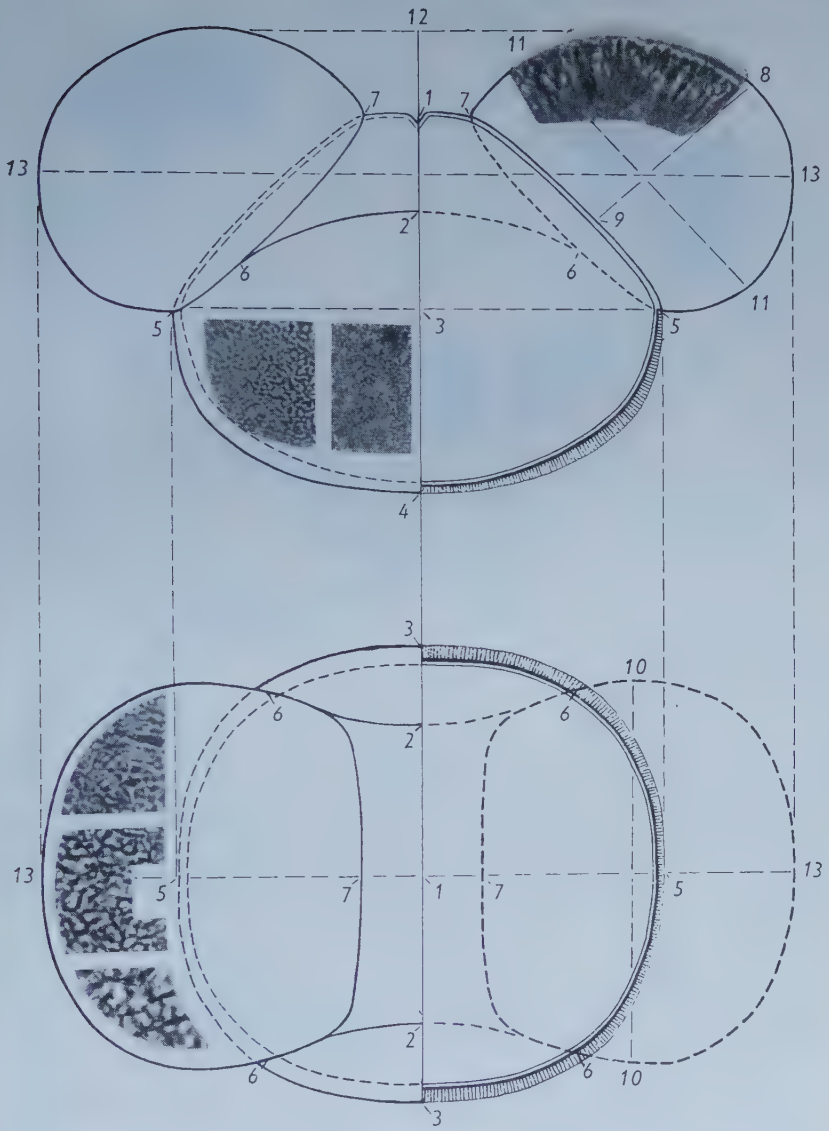


Fig. 4. *Pseudolarix kaempferi.* Palynogram. For explanation, cf. Pl. I. ×1000.

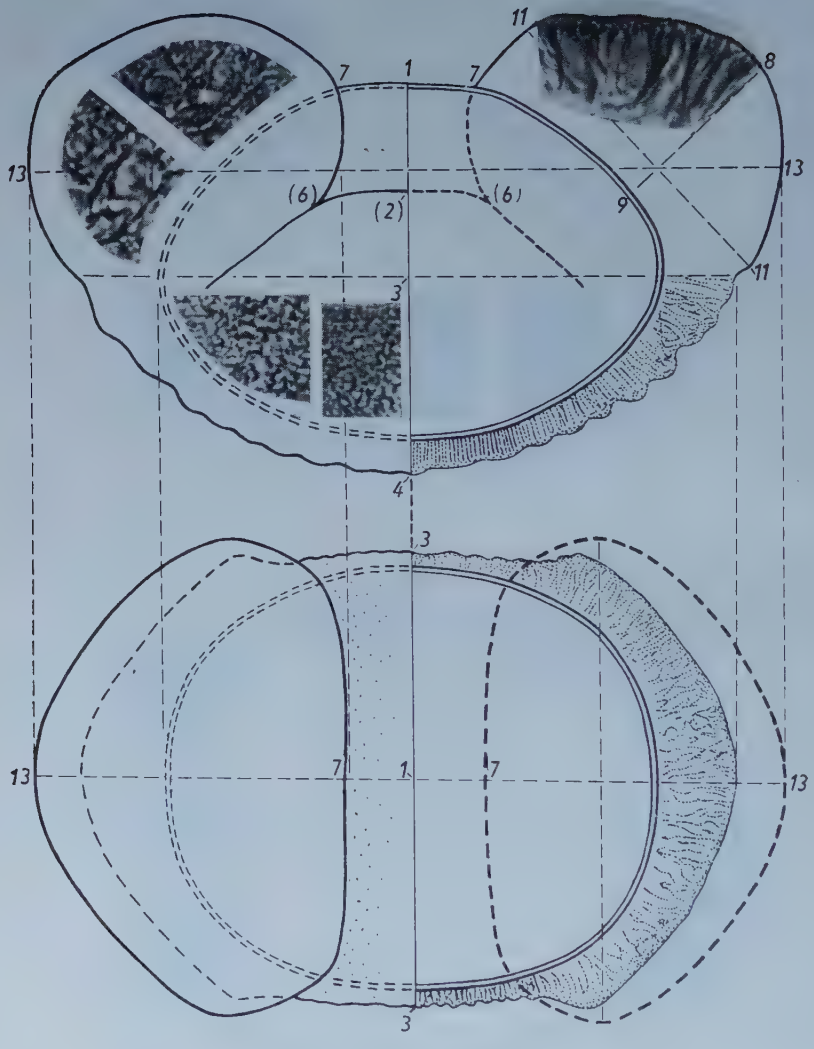


Fig. 5. *Cedrus deodara*. Palynogram. For explanation, cf. Pl. I. ×1000.

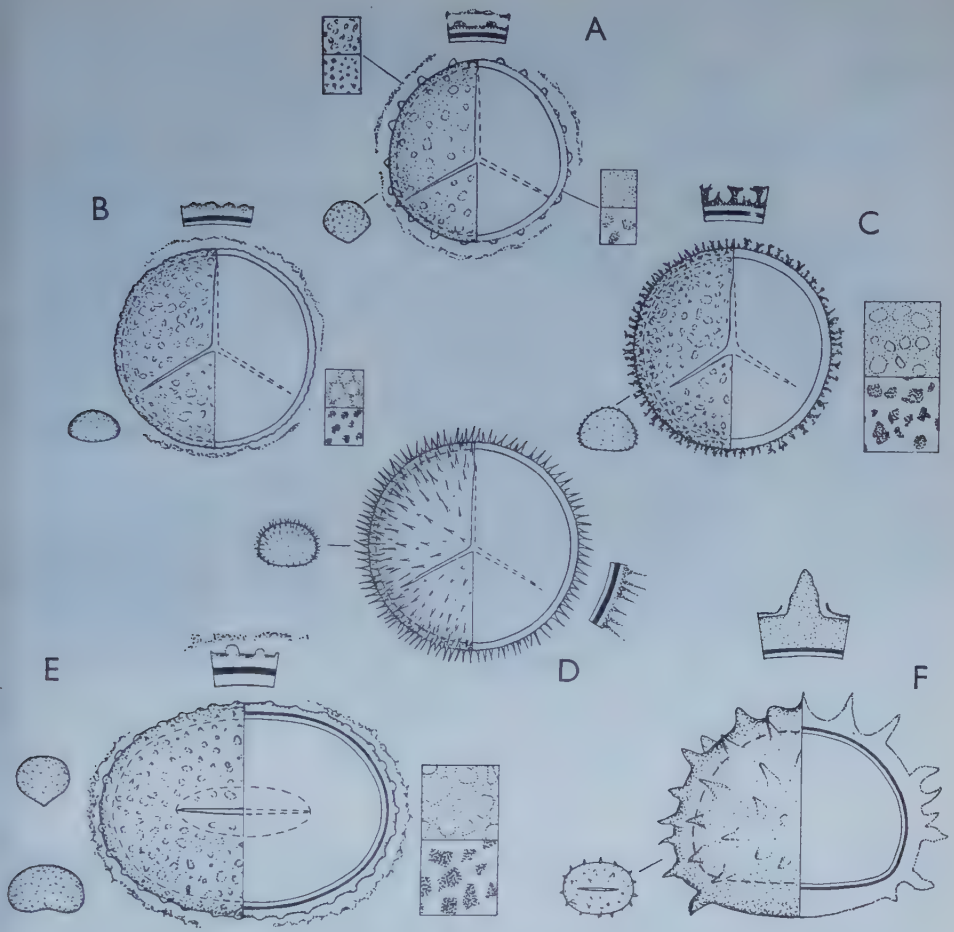


Fig. 6. Marattiaceae (palynograms). ×1000. — A, *Angiopteris longifolia*. B, *Macroglossum alidae*. C, *Archangiopteris henryi*. D, *Christensenia aesculifolia*. E, *Marattia fraxinea*. F, *Danaea elliptica*.

D), others have monolete ones (E, F). Fig. 7 gives a detailed analysis of the sclerine in *Ophioglossum coriaceum*. The main figure demonstrates the proximal, aperturiferous face of the spore. Particular interest attaches to the 'contact area', 'Y-mark' or 'trilete scar' marked by broken lines in this figure. In palynograms such lines represent apertures or other features situated above an optical section (cf. the right-hand part of the figure), or non-superficial features in a plane passing either through the equator or — in grains or spores seen in lateral view — through the polar axis, or else

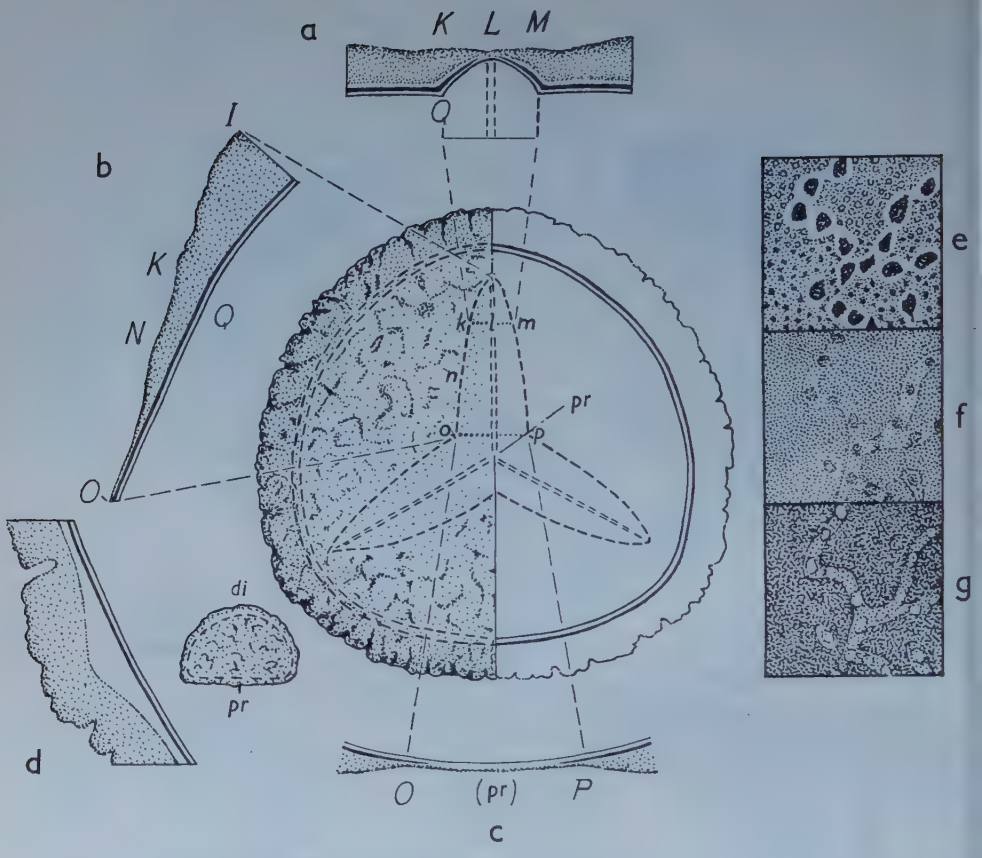


Fig. 7. *Ophioglossum coriaceum* (palynogram). Explanation in text below. ×1000.

situated between this plane and the observer (cf. the left-hand part of the figure). As indicated by three optical sections, a—c, the 'trilete scar' in *Ophioglossum coriaceum* is essentially an inner, not a surface feature. Along the 'scar' margins the thickness of the sclerine decreases towards the centre (Fig. b: I—O). A cross-section through a branch of the 'scar' shows a decrease in thickness towards the central radius or axis of the scar (Fig. a: K—L and M—L), except in the area at the proximal pole (*pr*). Here the branches of the scar anastomose (Fig. c: O—P) and the sclerine is thin throughout.

In suggesting a term for the aperture in fern spores it must be remembered that the terms 'monolete' and 'trilete' are generally accepted. The ending '-lete' is linguistically related with the noun laesura. The latter, therefore, has been proposed as a descriptive

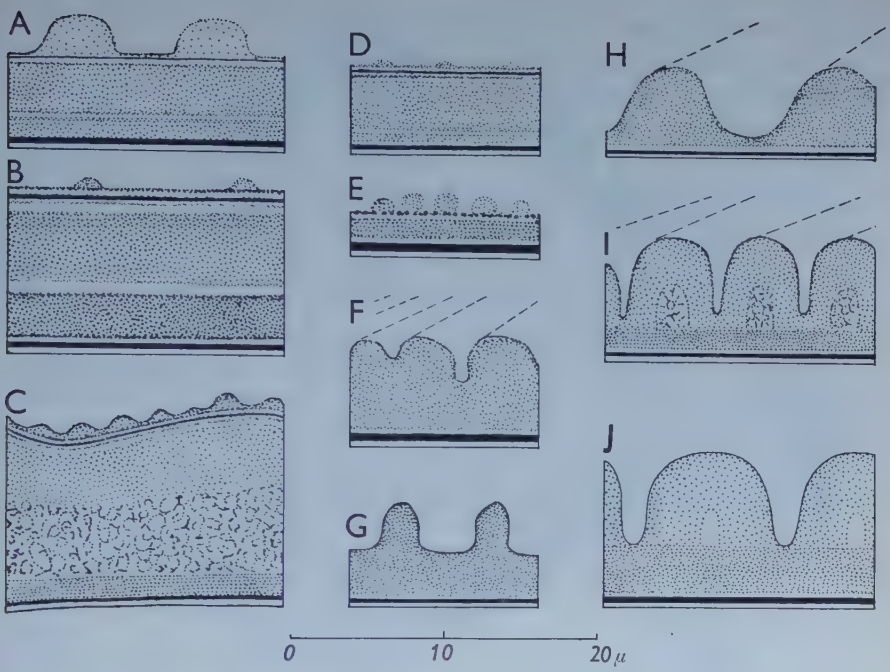


Fig. 8. Schizaeaceae. Sclerine stratification. × 2000. — A, *Lygodium circinnatum*. B, *L. volubile*. C, *L. micans*. D, *L. japonicum*. E, *Schizaea fluminensis*. F, *S. melanesica*. G, *Anemia phyllitidis*. H, *A. adiantifolia*. I, *A. anthriscifolia*. J, *Mohria caffrorum*.

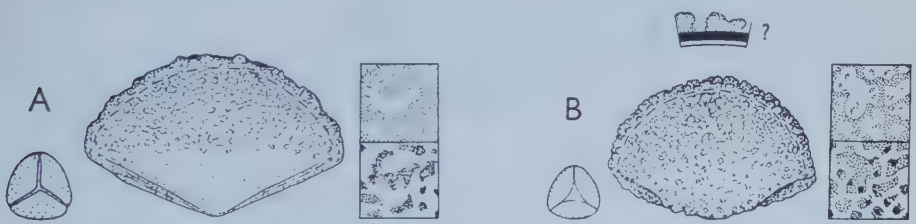


Fig. 9. Hedwigiaceae (palynograms). — A, *Hedwigia ciliata*. B, *Hedwigidium integrifolium*. × 1000.

term denoting a proximal aperture of practically the same type as that generally present in fern spores (Erdtman 1946 [see bibliography in "Pollen Morphology etc." 1952]). Monolete spores are 'monolaesurate', i.e. provided with one laesura. Trilete spores are 'trichotomolaesurate' rather than trilaesurate, which means that the laesura is trifid, not composed by three distinct laesurae. In several fern spore types a thin list is borne on top of the thinnest streak(s) of the laesura. Fig. 9 shows trilete moss spores.

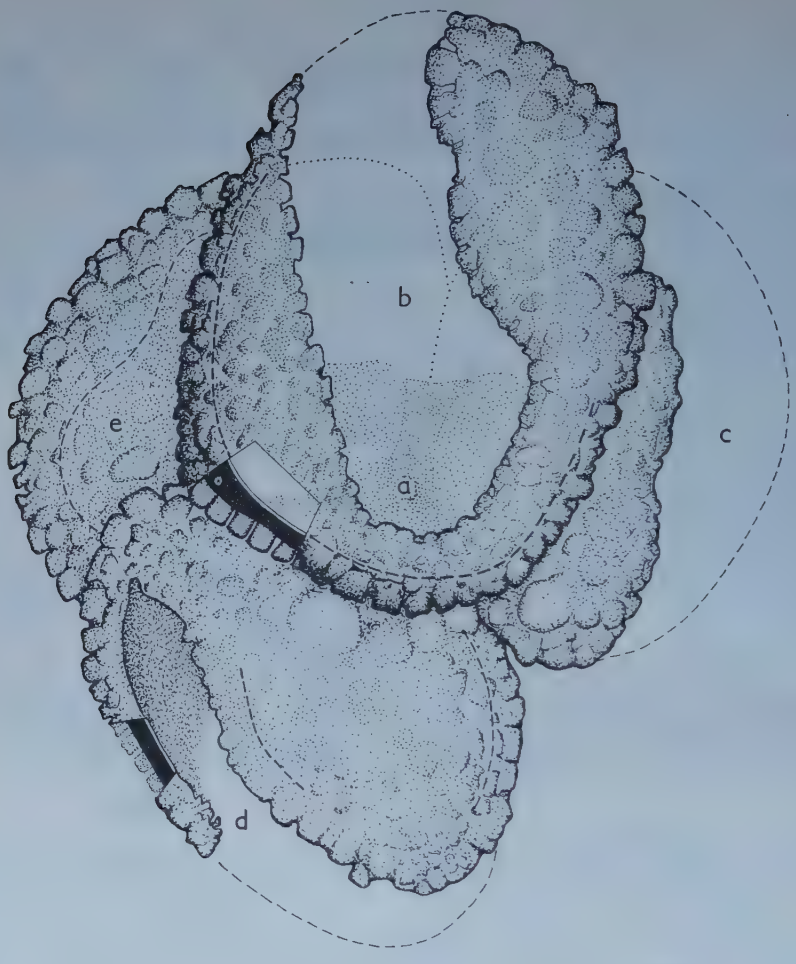


Fig. 10. *'Tetradosulcites magna'* (palynogram). ×1000.

The sclerine stratification is often complicated (cf. Fig. 8) and little is known about it. The time has not yet come for detailed analyses and comparisons with similar features in the pollen grains in angiosperms and gymnosperms.

Pl. III, an electron micrograph, shows the presence of two fairly distinct layers (ectonexine and endonexine, Erdtman 1948) in the nexine (Erdtman 1948, syn. 'Intexine' Potonié 1934) in pollen grains of *Centaurea ruthenica*.

Palynograms can also be used — particularly as an aid in interpreting photomicrographs — in descriptions of fossil spores. Fig. 10

illustrates the general habit, and the sclerine stratification of the individual grains, of spore quartets of common occurrence in certain early Jurassic strata in East Greenland (*Equisetites laevis* bed, Cape Stewart; the material has kindly been supplied by Professor T. M. Harris, F.R.S., Reading). In my notes they are provisionally referred to as '*Tetradosulcites magna*'. Sulcate grains of a similar type have not been encountered in recent plants. Slightly similar pollen types occur in certain monocotyledons and monocotyledonoid dicotyledons. However, it would be preposterous to base any conclusions regarding the affinities of '*Tetradosulcites*' on such grounds.

Personally, I am certainly no one-sided protagonist of palynograms. But I do think that future identification work will be furthered by palynograms of the type featured in Figs. 2–10 and, even more so, of the type published by Klaus (see Botaniska Notiser 1954; the palynogram is accompanied by a series of photomicrographs and a very careful diagnosis).

Photomicrographs alone, or combined with more or less cursory diagnoses, are sometimes of minor value. From among the rich and varied spore flora recently described in Palaeontographica (Bd. 95, Abt. B, 1953) I choose at random the sporomorph *Confusopollis confusus*, which is accompanied by the following description (l.c., p. 91 and Pl. 17, Fig. 3):

"*Confusopollis* n. gen.

Diagnose: Mit Resten von Luftsäcken. Germinalapparat besteht aus 1 - 3 Germinalien, die verschieden kräftig sind und unregelmässig auf der Exine verlaufen. Porus ist vorhanden.

Genotypus: *Confusopollis confusus*. Taf. 17 Fig. 3.

(1) *Confusopollis confusus* n. sp.

Diagnose: ca. 55 μ. Kontur rundlich, mit flachen Kerbbögen. Luftsäcke kaum reliefbildend in die Kontur, durch deutlichere rugulate Struktur ausgezeichnet. Colpus kräftig, mit breiten Cavernae, die den kreisrunden Porus umgreifen. Dickwandige Exine (ca. 3 μ).

Fundorte: lim. Lias Siegelsum.

Tafelhinweise: Taf. 17 Fig. 3 (Speciestypus)."

The illustration of *Confusopollis confusus* — reproduced in Fig. 11 in the present paper — shows that the sporomorpha is circular. It hardly provides any clear-cut additional information.

It goes without saying that vague diagnoses and unexpressive photomicrographs are of little or no value.

In the present state of affairs, therefore, it would be desirable, for more than one reason, to introduce — following a suggestion made by Dr. W. KLAUS, Vienna, at a conference held at Bromma in March 1954 — an "Index palynologicus" ("Index sporomorpharum" might possibly be a more adequate term), i.e., an index of fossil sporomorphs properly described and figured. Dr. KLAUS also sug-

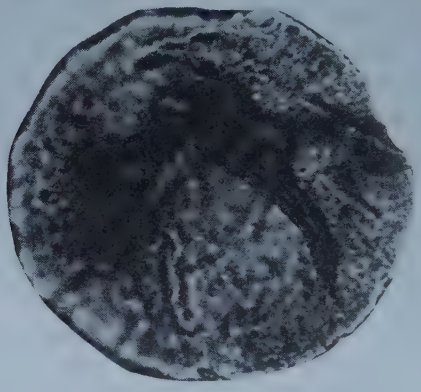


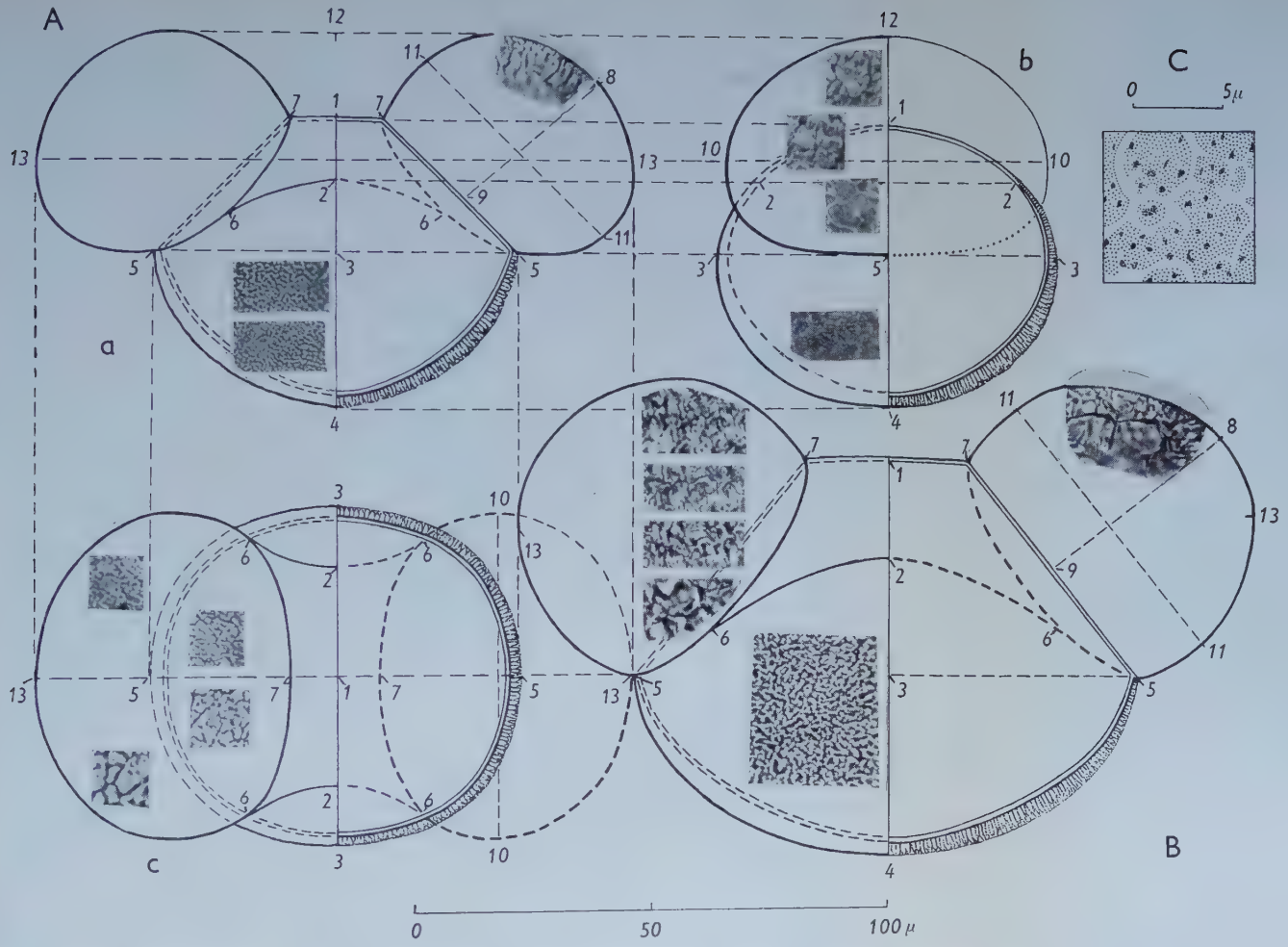
Fig. 11. *Confusopollis confusus.* — From Palaeontographica, Bd. 95, Abt. B, 1953 (Pl. 17, Fig. 3).

gested the establishment of another series, "Palynographica", consisting of monographies on sporomorphae of particular interest. The first number of this series is printed in Botaniska Notiser (Lund), 1954.

When collocating an international "Index sporomorpharum", strict nomenclatural rules must be followed. At the forthcoming Congress (Paris July 1954) new recommendations concerning sporomorph nomenclature will be made. I wish to suggest here that these recommendations be dealt with by a special sub-committee on palynological nomenclature and that this sub-committee be composed of seven members — three palynologists and four nomenclatural experts not actively engaged in descriptions of fossil sporomorphs.

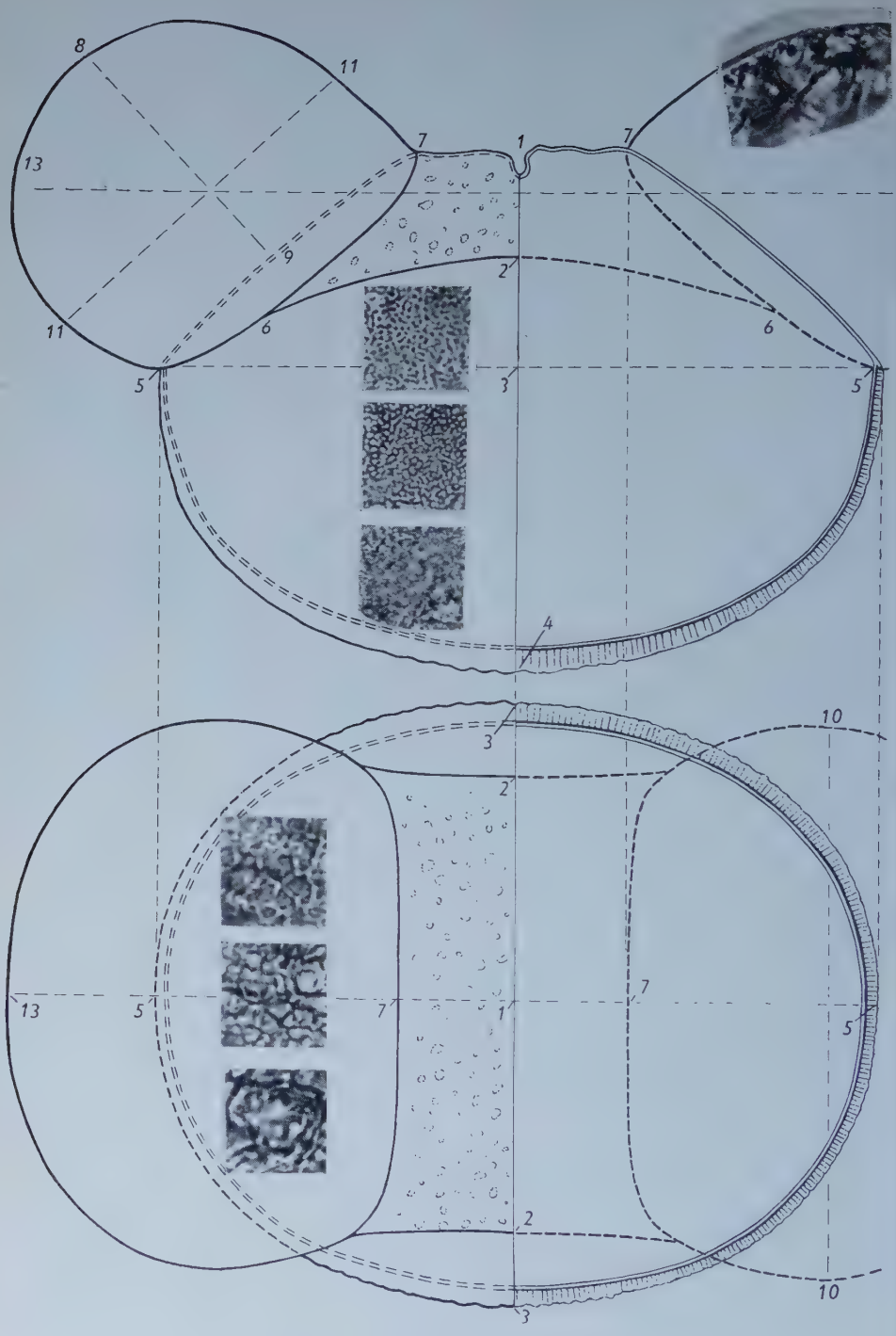
Methods. Terminology in Spore Morphology.

Absolute uniformity cannot be expected in this realm nor is it desirable in view of scientific progress. Meaningless discrepancies should, however, be ironed out by mutual agreement.

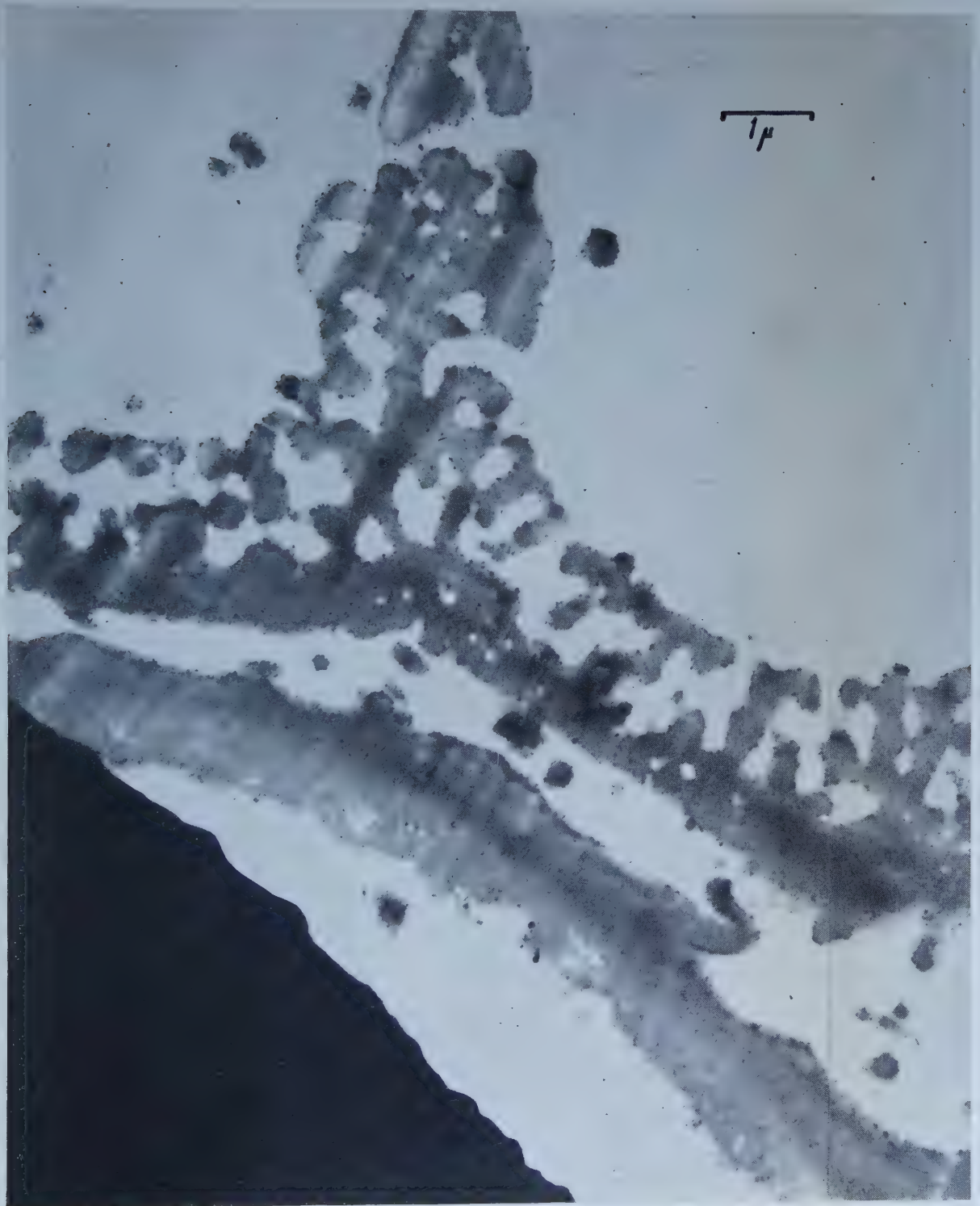


Pl. I. Pollen grains in *Abies*. — (A), *A. nephrolepis*: (a), lateral longitudinal view; (b), lateral transverse view; (c), polar view (distal face). × 650. — (B), *A. magnifica*, lateral longitudinal view. × 650. — (C), *A. mariesii*, saccus pattern (about × 2600).

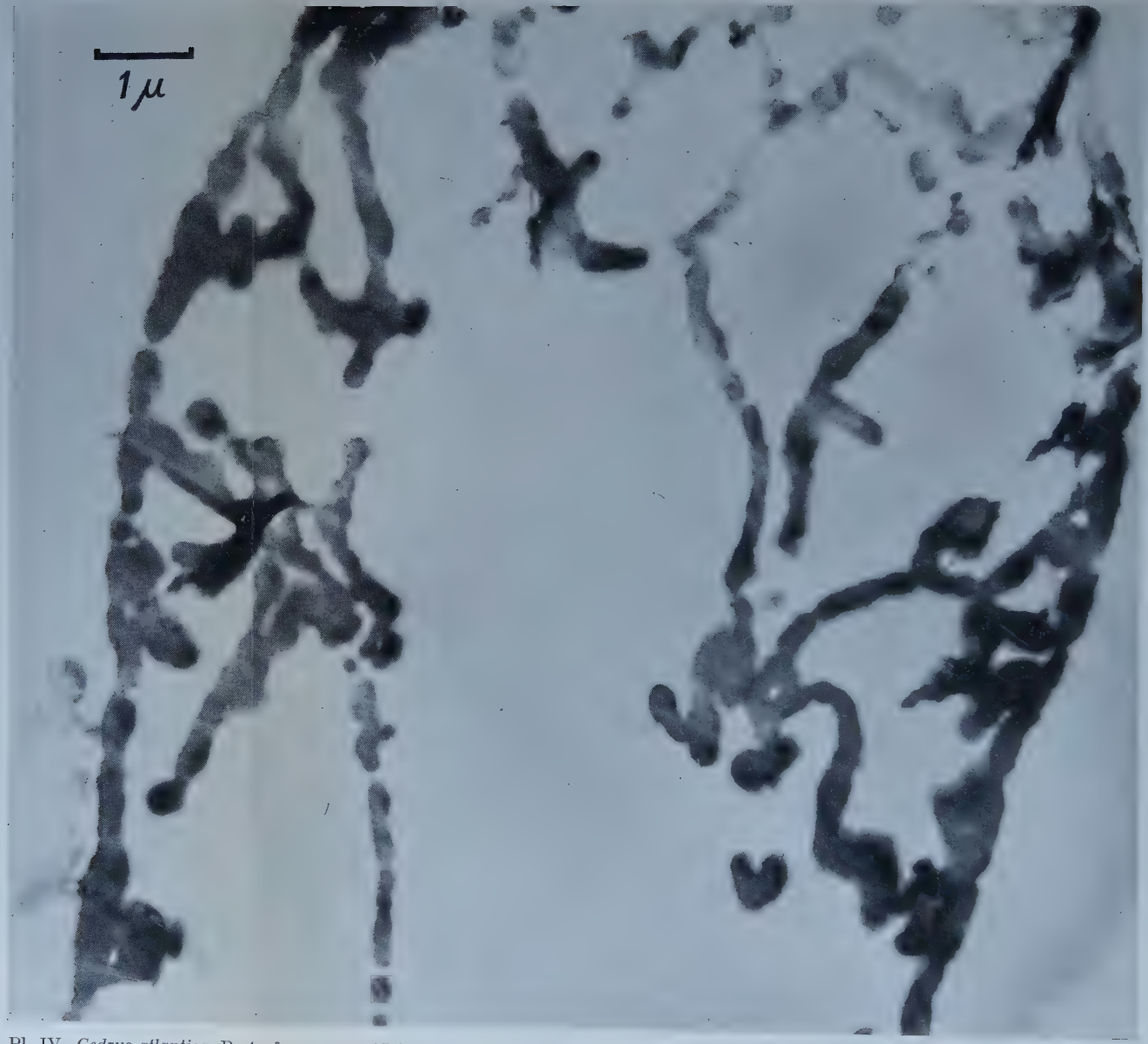
1: distal pole, 4: proximal pole. Corpus: height 1—4, breadth 5—5. Sacci: height 9—8, breadth 10—10, depth 11—11. Total grain: height 4—12 (A: a, b), breadth 13—13, depth 3(—5)—3 (A: b), 3(—2—1—2)—3 (A: c). Ten of the inserted photomicrographs show the pattern of the outer surface of the sacci at different foci (the uppermost photomicrograph in each saccus shows the pattern at high adjustment of the microscope, the lowermost the same at low adjustment). Two of the photomicrographs, in A: a and B, show a part of the saccus in optical section. The remaining four photomicrographs exhibit the pattern of the corpus. The photomicrographs in A: b are phase contrast pictures.



Pl. II. *Keteleeria davidiana*. Palynogram. ×1000.



Pl. III. *Centaurea ruthenica*. Part of exine. ×15 000.



Pl. IV. *Cedrus atlantica*. Part of saccus. ×15 000.

According to a circular just received ("Proposed method of preparation of recent pollen for international exchange") chlorination should be performed by adding 3—5 drops of concentrated hydrochloric acid to $^1/_2$—1 c.c. of concentrated sodium chlorate solution. These figures are found in an old paper of mine (possibly distorted by a misprint). A better prescription, published repeatedly in recent years, is as follows: "The polliniferous material is suspended in about 5 c.c. of glacial acetic acid. One (or two) drops of saturated sodium chlorate are added. After adding one or two drops of concentrated hydrochloric acid the fluid is stirred with a glass rod. Chlorine appears immediately. Its action is particularly effective in statu nascendi and bleaching is, as a rule, obtained in a few seconds."

It is often easier to observe fine sporoderm details in sporoderm fragments than in entire grains. Acetolyzed pollen grains, preferably larger than 15 μ, can easily be crushed in the following way: The grains are embedded in glycerine jelly on an ordinary slide and covered by a square or rectangular cover slip (which should not be too small or thin). With the jelly still fluent the cover slip is quickly moved to and fro under pressure applied by means of an india rubber. The glasses are then separated and the pollen fragments collected on the surface of a minute piece of glycerine jelly attached to a fine hook. The jelly is then melted on another slide, covered by a cover glass and sealed with paraffin.

Classification.

Spore classifications should be made on the broadest possible basis. To a superficial observer, it may seem easy to make a distinction between tetrads and monads, or saccate pollen grains and non-saccate ones, or between pollen grains provided with "lacunae" and those without, and so on. But in another, and wider, sense this is not always easy: more or less loose tetrads, "sacci in statu nascendi", for instance, lessen the sharpness of the distinction between tetrads and monads, as well as between saccate and non-saccate spores, etc.

Further complications arise from the fact that it is not always an easy thing to draw a clear morphological demarcation line between spores in the higher plants and those in the lower plants. Thus, acetolyzed spores of *Limnomyces neglectus*, a parasite of uncertain

systematic position (Phycomycetes?; cf. Lohammar in Svensk Bot. Tidskr., vol. 47, p. 526; spore illustrations l.c., Pl. II), have a pollinoid appearance. Further, micropalaeontologists sometimes come across "spores" and "cysts" of uncertain, or entirely obscure, systematic position.

Pending further morphological investigations of the pollen grains and spores in recent and fossil plants, it would seem best, for the time being, to use artificial, and certainly provisional, classifications serving special needs and interests. The classification adopted in "Pollen Morphology and Plant Taxonomy" is based essentially on the apertures, their situation, shape, and number (cf. l.c., Fig. 1, p. 13). The chief drawback of this classification resides in difficulties in defining the conception 'aperture' and in supplying adequate information as to the polarity and symmetry of the spores.

I am indebted to Prof. O. Selling for permission to reproduce Fig. 1. The electron micrographs, Plate III and IV, have been made at the Anatomical Institution of the Karolinska Institutet, Stockholm, by Barbro Afzelius, assistant at the Palynological Laboratory, Bromma.

The above lines are no more than an impromptu. They were inspired by the forthcoming palynological conferences scheduled in Paris in July 1954, and by a desire to pay a tribute to two distinguished friends, Dr. E. Asplund and Professor R. Florin.

Palynological Laboratory, Bromma, April 1954.

Svensk Botanisk Tidskrift. Bd 48, H. 2. 1954.

BULBILS IN THE INFLORESCENCES OF BUTOMUS UMBELLATUS.

BY

GUNNAR LOHAMMAR.

In 1941 Dr. A. Löve informed me by letter that he had found bulbils in the inflorescences of *Butomus umbellatus* when fixing flowerbuds for cytological investigations. As far as I know he is the first scientist who has observed this phenomenon in *Butomus*. He sent me material of his plant, which grew wild at Svalöv in the province of Skåne in southernmost Sweden, and I have kept it in culture for many years in the Botanical Garden of Uppsala.

A couple of weeks later I visited the outlet river of Lake Hyen in the parish of Stora Skedvi in the province of Dalarna, and there I found a multitude of flowering *Butomus* regularly bearing bulbils, and the bulbils were far more numerous, broad and conspicuous than in the plant from Svalöv. Malformed sessile flowers forming transitions between normal flowers and bulbils were very common (see the pictures, Pl. I and II: 1). It seemed evident to me that all the material of the locality belonged to one clone. Material from this locality was demonstrated at a meeting of the *Botaniska Sektionen* of Uppsala on October 5, 1943 (reported in this journal, Vol. 38, p. 121, 1944).

On account of these finds I began to look for bulbils in *Butomus* in other places also, and I have found bulbils in the following localities:

Province of Dalarna: parish of Torsång, Milsbo, in the rivulet between the lakes; parish of Husby, by the southern side of Lake Svinösjön; parish of Grytnäs, in the river by the parsonage; parish of By, Strandmora, below the road bridge.

Province of Uppland: parish of Tierp, Ubblixbo, in the river Tämnarån; parish of Uppsala-Näs, at the southern side of the inner part of the the Uppsala-Näs Bay.

Province of Småland: parish of Fliseryd, in the river Emmån just above the road-bridge near the railway station Fliseryd.

During his comprehensive investigations on the water plants of the Pojo Bay in southern Finland Dr. LUTHER discovered bulbils in the inflorescences of *Butomus* in a locality at the mouth of River Svartån into the Pojo Bay, and this observation has been mentioned briefly in his papers (LUTHER 1951, I p. 132; II p. 164). In 1948 Dr. LUTHER and I found bulbils in *Butomus* at two more Finnish localities, like the preceding one situated in Regio aboënsis, viz. in the parishes of Koskis (River Pemar å) and Karis (River Svartån) (LOHAMMAR & LUTHER 1952).

The picture, Pl. II: 1, shows that the size and the form of the bulbils within an inflorescence vary rather widely. *Butomus* clones of different provenience show in fact characteristic differences. The bulbils of the Svalöv plant are, for instance, much thinner than the bulbils pictured here.

Crossing a diploid *Butomus* from the vicinity of Luleå in northern Sweden with a triploid plant from Belgium I got about 50 descendants belonging to F_1; three of them had bulbils, and in one plant the bulbils were considerably larger than in the clone from the outlet river of Lake Hyen. Not one of the parents used to produce bulbils.

The majority of the wild Swedish clones with bulbils which were found have been kept in culture in the Botanical Garden of Uppsala. The clones from Grytnäs, Tierp, Uppsala-Näs and Fliseryd produced no bulbils. The clone from Svalöv gave only small and quite few bulbils, and the clones from the outlet river of Lake Hyen and from Husby produced bulbils as in nature. The development of bulbils is evidently often a very labile characteristic. The microclimate of the culture tubs certainly differs in many respects — for instance in regard to air humidity — from that of the natural habitats, and microclimatic factors may have an influence on the formation of bulbils. Also, the soil-mixture in the tubs differs from the soil of the natural habitats.

I have sectioned bulbils of *Butomus* from the outlet river of Lake Hyen and 3 sections are pictured in Pl. II: 2 and III. The bulbil consists of a large basal part of lacunary parenchymatic tissue which is traversed by small vascular bundles. On the upper side of the basal part one finds a stem primordium enveloped by tightly rolled leaf primordia. On the sides of the central stem primordium

one may find one or two smaller stem primordia, which may possibly be considered as branches of the central one. In the axils of the leaf primordia there are small axillary scales as in the axils of the common leaves (Kirchner, Loew & Schröter 1908). In the basal part of the bulbil just below the leaf primordia there are numerous initials of adventitious roots (Pl. III: 2).

Bulbils placed in warm water in the summer will begin to develop at once (Pl. IV). Bulbils placed in cold water in the autumn remain resting until next spring, and the clump of bulbils remains coherent all the time.

The role of these aerial bulbils for the vegetative dispersal of *Butomus* is unknown. Characteristic and easily recognizable clones of *Butomus* grow in some lakes and rivers. Often one finds only one clone in a lake, and this clone may be found in different bays, which makes it quite clear that a vegetative dispersal has taken place. (There are no observations suggesting parthenogenesis in the genus.) The freely branching rhizomes which produce subterrestrial bulbils also, may be torn to pieces by the ice cover and then carried by the water currents to other habitats. Fresh stalks bearing bulbils are floating on the water surface (as are also the rhizomes), and the chances for the outgrowing roots to find a hold in the bottom at a suitable depth are perhaps small. When the stalks have passed the winter in water (or ice) they do not float any longer, and the bulbils may then be deposited on the bottom. But attention may here be called to the following fact, which probably highly diminishes the opportunities of the aerial bulbils to contribute to the dispersal of the plant: *Butomus* is very commonly attacked in the autumn by a parasitic fungus, which destroys the inflorescences, the stalks and also the bulbils as long as they are in the air.

It must be considered to be a feature of imperfectness that the bulbils do not drop off individually from the mother plant but the whole clump remains attached to the bearing stalk.

All the material illustrated in this paper is from the outlet river of Lake Hyen, and the photos were taken by the author.

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Explanation of the Plates.

Pl. I.

Inflorescences of *Butomus umbellatus* with bulbils and malformed flowers at the base of the normal fruit-stalks. Natural size. — 16.8. 1943.

Pl. II.

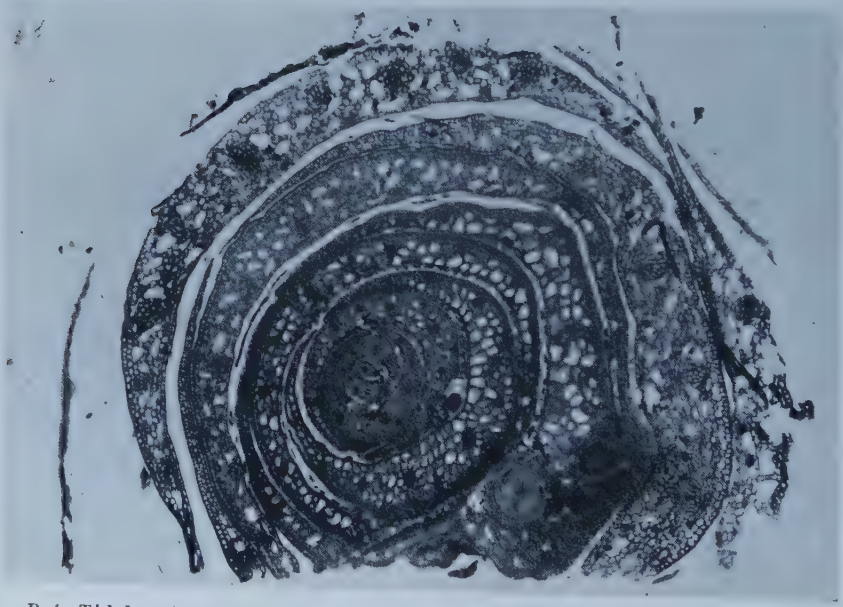
1. Detached bulbils from *one* inflorescence. The two specimens to the left in the topmost row possess some malformed petaloids and stamina. 3 × 1. — 17.8. 1943.
2. A transverse section through the leaf primordia of a bulbil. To the right in the lower part of the picture there is an initial of a lateral bud.

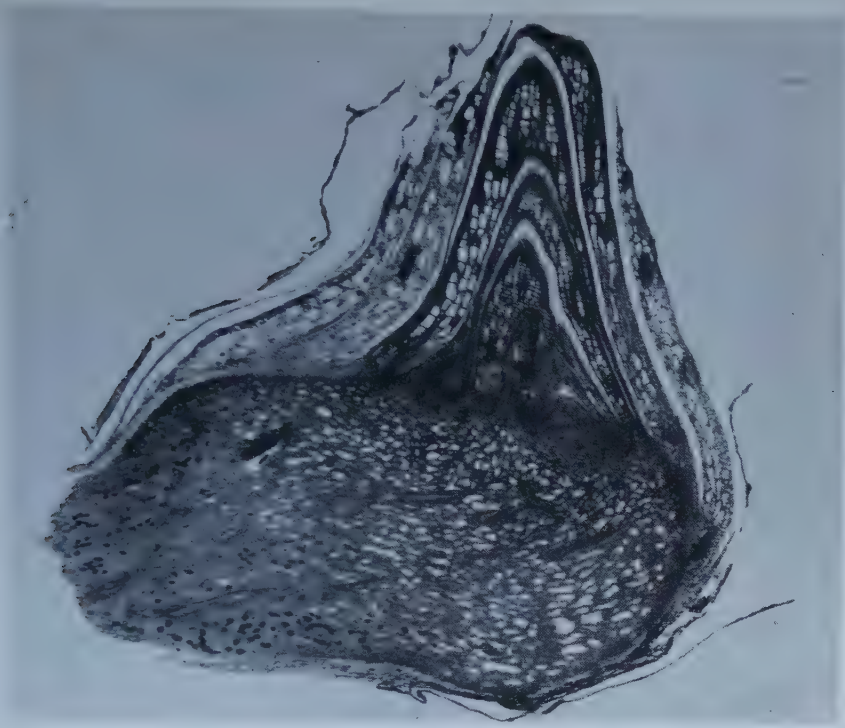
Pl. III.

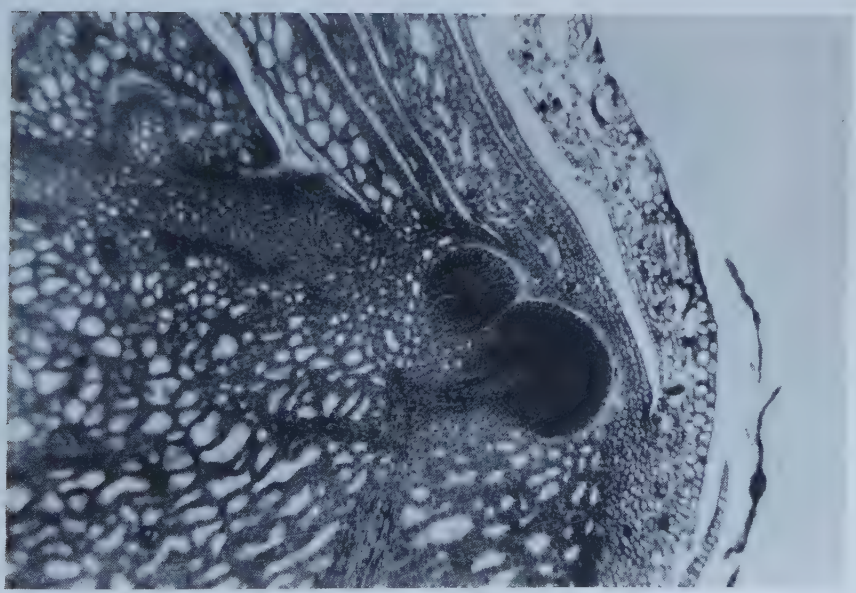
1. Longitudinal section of a bulbil. On each side of the central stem primordium there is a lateral stem initial.
2. Longitudinal section of a bulbil. At the base of the leaf primordia two initials of adventitious roots are seen.

Pl. IV.

The topmost inflorescence of Pl. I, 15 days later. In the meantime the stalk had been kept in a horizontal position on a mud surface which was covered by about 15 centimeters of water. Numerous roots have grown out from the bulbils down into the mud and green leaves are ascending. — 31.8. 1943.







Svensk Botanisk Tidskrift. Bd 48, H. 2. 1954.

THE EMBRYO-SAC DEVELOPMENT OF VITTADINIA TRILOBA (GAUD.) DC.

BY

GUNNAR HARLING.

In a paper of 1922 Palm studied the embryo-sac development in *Vittadinia triloba*. According to his description it takes place in the following manner. The archespore is unicellular. The embryo-sac mother-cell (EMC) passes through the meiotic divisions without any cell-walls being formed. This results in a 4-nucleate coenomacrospore (CMS) with the nuclei in linear position. In the CMS the two apical CMS-nuclei are considerably larger than the two basal ones, which generally degenerate sooner or later. The embryo-sac (ES) is constituted by two divisions of the two apical CMS-nuclei. An 8-nucleate ES is thus formed, containing egg apparatus, two polar nuclei and two antipodes, the upper of which is 2-nucleate. In later stages an increase in the number of antipodes takes place. Sometimes as many as eleven or twelve antipodes may be formed. Palm also describes certain deviations from the development just related. The two basal CMS-nuclei may occasionally possess more vitality than they normally do and in such cases they are able to take part in one or both of the ES-divisions. The further development in these deviating cases has not been followed by Palm.

The type of ES-development described above is considered by Palm to be a variation of the bisporic *Allium* or *Scilla* type, because generally only two CMS-nuclei take part in the formation of ES. In the same manner Palm (1915) interpreted the similar ES-development in *Chrysanthemum* (*Tanacetum*) *vulgare* as bisporic. Palm's conception is shared by Schnarf (1929) and Maheshwari (1937). The vast majority of embryologists have, however, sharply criticized it. Afzelius (1924), Chiarugi (1927), Martinoli (1940, 1942), Fagerlind (1941) and Harling (1951 *a*, *b*) have all em-

phasized that the ES-development in the cases mentioned above should undoubtedly be classified as tetrasporic, though of a somewhat reduced and deviating kind. In an earlier paper (Harling 1950) I introduced the term pseudobisporic for cases where only two CMS-nuclei of a 4-nucleate CMS participate in the ES-formation.

In some cases at least Palm also seems to have misinterpreted his material. This is especially clear in his description of the formation and development of the antipodes. I have already earlier (Harling 1951 *b*, p. 103) criticized this part of his paper. One thing should be added, however. Palm is of the opinion that in cases where three 1-nucleate antipodes are present, these will have arisen secondarily from the type with two antipodes, the upper of which is 2-nucleate. A cell-wall will thus have appeared between the nuclei in the upper antipode, after the two primary antipodes have already been formed. This is probably incorrect. The antipodes in the *Compositae* with 8-nucleate ES are from the beginning two or three in number. No transition from one type to the other has ever been observed.

One more thing in Palm's paper makes a strange impression, viz. the strongly vacuolized dyad in Fig. 2, p. 90. That this figure does not illustrate an abnormal stage in the material is clear from the following citation (p. 91): "two vacuoles are constantly present at this stage, a larger one between the two nuclei and a small one above the micropylar nucleus." In normal-sexual plants vacuolization does not in general take place before germination of the MS (CMS). Vacuolization at the dyad stage or earlier is, on the other hand, a common phenomenon in agamospermous species with unreduced ES. Therefore one may suspect that at least a part of the ES in Palm's material has been unreduced and that in reality he has been dealing with a species totally or partly agamospermous.

In order to clear up the doubtful parts of Palm's paper I have myself made an investigation of the macrogametophyte formation in *Vittadinia triloba* (Gaud.) DC. Seeds of this species were obtained from the Botanical Garden, Wellington, New Zealand, in 1951. They were sown in the Hortus Bergianus, Stockholm, where a lot of plants flowered in the summers of 1952 and 1953. The macrogametophyte formation takes place in the following manner. The archespore is unicellular. Fig. 1 *a* shows an EMC in diakinesis. The number of gemini is 9. At the heterotypic division a cell-plate is laid down, which is later transformed into a persistent wall (Fig. 1 *b*). Also after the homotypic division cell-walls are formed, resulting in a tetrad

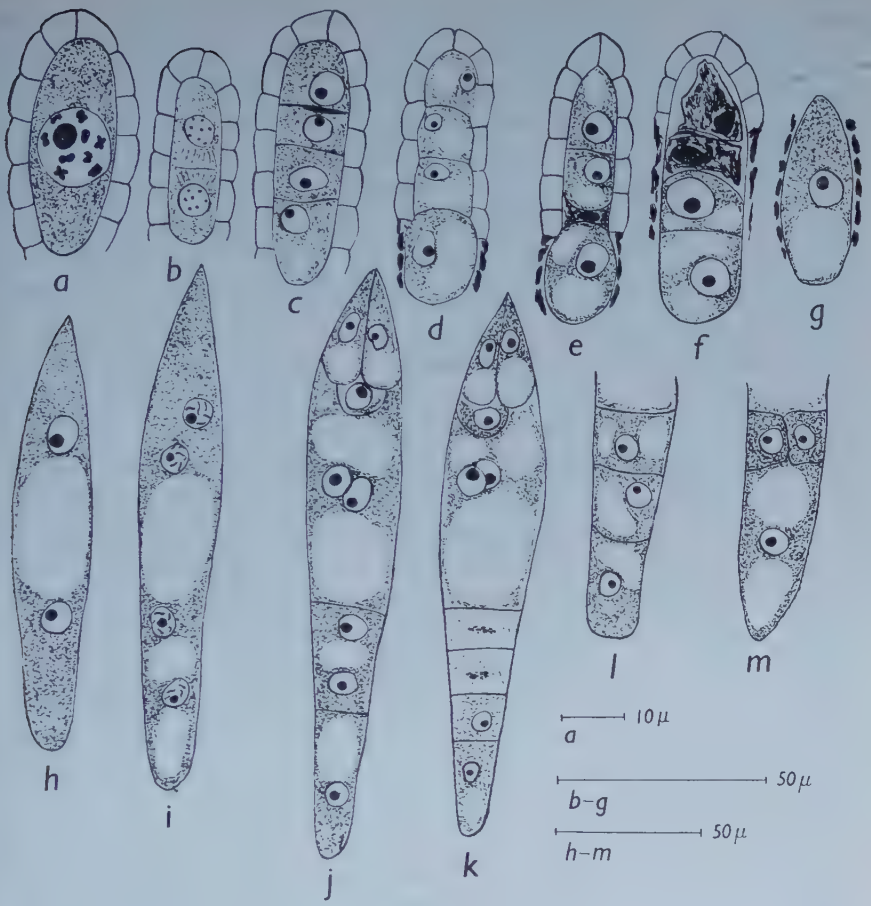


Fig. 1. Macrosporogenesis and ES-development in *Vittadinia triloba* (GAUD.) DC. — *a*, EMC. *b*, Dyad stage. *c*, Tetrad stage. *d—f*, Germination of ES. *g—m*, Different stages in ES-development.

of four linearly placed MS (Fig. 1*c*). The conditions connected with the germination of MS fluctuate somewhat. Mostly two or three, sometimes all four MS germinate into 1-nucleate ES (Fig. 1*d—f*). Among the germinating MS is always the chalazal one, which as a rule gives rise to the definitive ES (Fig. 1*g*). The three upper MS are at the same time pressed together and degenerate. Among these the micropylar one is generally best developed; in rare cases it may supersede even the chalazal MS. At the 1-nucleate stage the surviving ES grows rapidly while at the same time the nucellus degenerates. Now the ES forces its way through the remnants of the nucellus and

then borders directly upon the innermost cell-layer of the integument. Through three synchronous divisions an 8-nucleate ES is organized in the usual manner (Fig. 1*h–j*). The ES-development consequently follows the normal (or *Polygonum*) type. Concerning the formation of the antipodes certain variations are present. Generally there are three 1-nucleate antipodes, which may lie in a single row (Fig. 1*l*) or in a T-shape (Fig. 1*m*). I have also found a few ES with two antipodes, the upper of which was 2-nucleate (Fig. 1*j*). Secondary increase in the number of antipodes may also occur as is shown in Fig. 1*k*.

The account given above shows that the development of the macrogametophyte in my material is quite different from that in PALM's. The reason is undoubtedly that PALM and I have studied material of different plant species. My own material has been checked by Mr. ERIK SÖDERBERG, Assistant at the Hortus Bergianus, and by myself and compared with specimens from Australia and New Zealand in the herbarium of the State Museum of Natural History, Stockholm. On the other hand we know that PALM sometimes accepted garden determinations without careful checking. What is it then that PALM has investigated? He collected the material for his study in the Botanical Garden of Buitenzorg, Java. Here, as in most botanical gardens, there probably grew a plant often called *Vittadinia triloba* hort. This name indicates, however, no *Vittadinia*. It is an unscientific synonym of *Erigeron Karvinskianus* DC. or the probably inseparable var. *mucronatus* (DC.) ASCHERS. (= *E. mucronatus* DC.), a native of Mexico but spread as a weed in many tropical and subtropical countries. The name *Vittadinia triloba* hort. has probably arisen in the following way. In 1856 SONDER published a species named *Erigeron trilobus* SOND. This species is considered by the Index Kewensis to be a synonym of *Vittadinia triloba* DC. According to STANDLEY (1926) SONDER's *E. trilobus* is, however, nothing else but *E. Karvinskianus* DC. On the other hand the synonyms enumerated by SONDER all belong to *Vittadinia triloba* DC.

No doubt it was in reality *Erigeron Karvinskianus* that PALM collected for his investigation under the name of *Vittadinia triloba* hort. Then, without further checking, he applied DC. as author. The definite proof of the correctness of my opinion appears when a comparison is made between the embryology of *Erigeron Karvinskianus* and that of *Vittadinia triloba* as described by PALM. *E. Karvin-*

skianus (or *E. mucronatus*) has been embryologically studied by Carano (1919, 1920, 1921, 1924), Fagerlind (1944, 1947) and Battaglia (1950). The species is shown to be at least partially agamospermous and a large percentage of unreduced ES are formed. The unreduced dyads are always vacuolized (compare Fig. 2*g*, p. 228 in Fagerlind 1947 with Palm's Fig. 2, p. 90). The ES-formation in *E. Karvinskianus* is tetrasporic as in most *Erigeron* species (cf. Harling 1951*b*, p. 109). Furthermore there is a strong tendency towards suppression of the chalazal part of the ES, causing the chalazal nuclei to become smaller than the micropylar ones. In Fagerlind's material only 8-nucleate mature ES were met with and only three small-nucleate antipodes were formed. All these details agree perfectly with Palm's description. Carano, who apparently studied a different biotype from Fagerlind's, found besides 8-nucleate ES also ES with a larger number of nuclei. These last-named ES probably correspond to the many-nucleate ES incidentally observed by Palm.

From my investigation it is evident that Palm never studied *Vittadinia triloba* DC. The term *Vittadinia* type, often used in the embryological literature in cases exhibiting tetrasporic, pseudobisporic ES-development (cf. e.g. papers by Chiarugi 1927, Martinoli 1940, 1942) must therefore disappear. If another term of the same kind should be needed, I think *Nananthea* type would be the most suitable one. In *Nananthea perpusilla* DC. Martinoli (1940) found an ES-development coinciding in all essentials with that described by Palm in his "*Vittadinia triloba*".

In the tribe *Astereae Erigeron* and *Vittadinia* are the only genera in which tetrasporic ES-development has been reported. These genera have also generally been regarded as nearly related to each other. Hoffmann (1894) places *Vittadinia* in immediate connection with *Erigeron*, mentioning as separating characters only rather insignificant differences in the number and arrangement of the ligules and the development of the pappus-bristles. In a previous paper (Harling 1951*b*, p. 116) I wrote: "If tetrasporic ES-development proves to be a constant feature in *Vittadinia*, one should perhaps consider the advisability of including this genus as a section in *Erigeron*." Since Palm's mistake has now been cleared up, all ideas of that kind must of course be abandoned. *Erigeron* is now unique in its tribe as regards the occurrence of tetrasporic ES. All other genera which have been investigated embryologically, follow

in their ES-development the normal type. Through the embryological facts published in this paper, the gulf between *Erigeron* and *Vittadinia* has therefore become further widened. At the same time the last-named genus is brought nearer to *Aster* and to the other genera with monosporic ES. *Vittadinia* is known mainly from Australia, New Zealand and New Guinea. Its nearest relatives should probably be sought in the genera *Olearia*, *Celmisia* and *Tetramolopium*, which have a range coinciding at least partially with that of *Vittadinia*. All these genera are, however, still embryologically unknown.

Finally a remark concerning the nomenclature in *Vittadinia* should be added. The commonest and best known species is usually called *V. australis* A. Rich. It was originally described from New Zealand. Bentham (1866) enumerates among his synonyms of *V. australis* i.a. *V. triloba* DC., described on Australian material. That the two names are really to be regarded as synonyms is beyond all doubt. I myself have compared material from Australia and New Zealand without being able to find any species-separating characters. *V. triloba* was, however, first described by Gaudichaud (1826) under the name of *Brachycome triloba*. It was later transferred by De Candolle (1836) to the genus *Vittadinia*, established by Richard in 1832. According to the International Rules of Nomenclature the valid name of the species should therefore be *Vittadinia triloba* (Gaud.) DC.

It is my pleasant duty to express to Mr. Erik Söderberg my sincere thanks for having drawn my attention to the possibility of Palm's mistake, further for valuable help in solving the nomenclatural problems and for procuring on my behalf the seeds of *Vittadinia triloba*.

Summary.

An investigation made by Palm in 1922 on the embryo-sac formation in *Vittadinia triloba* DC. is shown to be entirely wrong. Palm did not study this species but "*Vittadinia triloba* hort.", which is an unscientific synonym of *Erigeron Karvinskianus* DC., an agamospermous plant with tetrasporic ES-development. My paper also shows that the real *Vittadinia triloba* DC. follows the normal type in its ES-development just as do all other genera in the tribe *Astereae* with the exception of *Erigeron*. The term *Vittadinia* type, often used

in the embryological literature, must therefore disappear. Finally it is pointed out that the name *Vittadinia triloba* (GAUD.) DC. has priority over *V. australis* A. RICH.

University of Stockholm, December 1953.

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OM CELLINNEHÅLLET I GYMNOSPERMERNAS OCH CHLAMYDOSPERMERNAS ENDOSPERM.

av

ERIK SÖDERBERG.

Kemisterna, t. ex. H. Erdtman (1949, 1953) och hans medarbetare, ha på senare tid genom sina undersökningar lämnat värdefulla bidrag till förståelsen av barrträdens fylogeni och systematik. Reservnäringen i gymnospermfröna är fortfarande ett föga beaktat område för kemisk och botanisk forskning. I min uppsats »Om partenokoni och diöci hos släktet *Pinus*» (1953) publicerade jag en översikt av stärkelseförekomsten i olika tallarters frön. En större eller mindre mängd stärkelse finnes i fröna hos ett stort antal tallarter, medan andra tallarters frön äro stärkelsefria. I den botaniska och dendrologiska litteraturen uppges vanligen att koniferernas frön i regel innehålla aleuron och fet olja. En tabellarisk översikt av förekomsten av stärkelse, aleuron och fet olja i gymnospermernas och chlamydospermernas frön saknas. På grundval av egna iakttagelser och de uppgifter, som publicerats av Burgerstein (1900) och C. o. E. von Tubeuf (1917) och refererats av Schnarf (1937), ha nedanstående tabeller upprättats för att stimulera till fortsatta iakttagelser. Familjerna *Cycadaceae* och *Pinaceae* ha utelämnats på grund av brist på undersökningsmaterial och alltför få litteraturuppgifter. Ur systematisk synpunkt äro tabellerna ordnade efter Florin & Boutelje (1954), Li (1953) och Pulle (1950) samt Pilger (1926).

Som synes av Tabell I påvisade Burgerstein (1900) endast stärkelse i endospermet hos *Agathis* och *Araucaria*, under det att C. & E. von Tubeuf (1917) även konstaterade minimala mängder olja och aleuron hos de av dem undersökta arterna.

Inom familjen *Podocarpaceae*, som består av mer än 150 arter, äro endast fyra *Podocarpus*-arter undersökta. *P. elatus* R. Br. och *P. neriifolius* D. Don, vilka tillhöra undersektionen B (Buchholz & Gray 1948) av sektionen *Eupodocarpus*, bilda enbart stärkelse i

Tabell I. Gymnospermae, endosperminnehåll.

	Stärkelse	Aleuron	Olja	Förf.
Klass: ***Coniferae***				
Ordning: ***Araucariales***				
Fam. *Araucariaceae*				
Agathis alba (Lamb.) Foxworthy	+	–	–	Burgerstein
Araucaria angustifolia (Bertoloni) K. Koch	+	–	–	Burgerstein
A. araucana (Molina) K. Koch	+	+	+	Tubeuf (Burgerstein)
A. Bidwilli Hook. fil.	+	+	+	Tubeuf (Burgerstein)
A. excelsa (Lamb.) R. Br.	+	+	+	Söderberg
Ordning: ***Podocarpales***				
Fam. *Podocarpaceae*				
Podocarpus dacrydioides A. Rich. (Sekt. *Dacrycarpus*)	+	+	+	Söderberg
P. elatus R. Br.	+	–	–	Burgerstein, Söderberg
P. neriifolius D. Don (Sekt. *Eupodocarpus* Subsekt. B)	+	–	–	Söderberg
P. nivalis Hook. (Sekt. *Eupodocarpus* Subsekt. D)	+	+	+	Söderberg
Ordning: ***Cupressales***				
Fam. *Taxodiaceae*				
Sciadopitys verticillata (Thunb.) Sieb. et Zucc.	–	–	+	Burgerstein, Tubeuf
Sequoia sempervirens (Lamb.) Endl.	–	+	+	Burgerstein, Söderberg
Sequoiadendron giganteum (Lindl.) Buchh.	–	+	+	Burgerstein
Metasequoia glyptostroboides Hu et Cheng	–	+	+	Söderberg
Taxodium distichum (L.) A. Rich.	–	+	+	Burgerstein
T. mucronatum Tenore	–	+	+	Söderberg
Cryptomeria japonica (L. fil.) D. Don	–	+	+	Burgerstein, Söderberg
Cunninghamia lanceolata (Lamb.) Hook.	–	+	+	Burgerstein
Fam. *Cupressaceae*				
Actinostrobus acuminatus Parl.	–	+	+	Söderberg
A. pyramidalis Miq.	–	+	+	Burgerstein, Söderberg
Callitris cupressiformis Vent.	–	+	+	Burgerstein, Söderberg
C. glauca R. Br.	–	+	+	Söderberg

	Stärkelse	Aleuron	Olja	Förf.
C. Muelleri Benth. et Hook. fil. . .	–	+	+	Burgerstein, Söderberg
C. robusta R. Br.	–	+	+	Söderberg
C. tasmanica R. T. Baker et H. G. Sm.	–	+	+	Söderberg
Widdringtonia cupressoides (L.) Endl.	–	+	+	Söderberg
W. dracomontana Stapf	–	+	+	Söderberg
W. Schwarzii Mast.	–	+	+	Söderberg
Austrocedrus chilensis (D. Don) Florin et Boutelje	+	+	+	Söderberg
Tetraclinis articulata (Vahl) Mast. .	–	+	+	Söderberg
Cupressus Macnabiana Murr. . . .	–	+	+	Burgerstein
C. macrocarpa Gord.	–	+	+	Burgerstein
C. sempervirens L.	–	+	+	Burgerstein, Tubeuf
C. torulosa D. Don	–	+	+	Burgerstein
Chamaecyparis Lawsoniana (Murr.) Parl.	–	+	+	Burgerstein
C. nootkatensis (Lamb.) Spach . . .	–	+	+	Burgerstein
C. obtusa (Sieb. et Zucc.) Endl. . .	–	+	+	Söderberg
Thujopsis dolabrata (L. fil.) Sieb. et Zucc.	–	+	+	Burgerstein, Söderberg
Thuja plicata Lamb.	–	+	+	Burgerstein
Biota orientalis (L.) Endl.	–	+	+	Burgerstein, Tubeuf
Heyderia decurrens (Torr.) K. Koch	+	+	+	Tubeuf, Söderberg
Juniperus chinensis L.	–	+	+	Burgerstein
J. phoenicia L.	–	+	+	Burgerstein
J. radiata Sieb. et Zucc.	–	+	+	Söderberg
J. virginiana L.	–	+	+	Burgerstein
Ordning: ***Cephalotaxales***				
Fam. *Cephalotaxaceae*				
Cephalotaxus Harringtonia K. Koch v. *drupacea* (Sieb. et Zucc.) Koidzumi	+	+	+	Burgerstein, Söderberg
C. Fortunei Hook.	+	+	+	Tubeuf
Klass: ***Taxinae***				
Ordning: ***Taxales***				
Fam. *Taxaceae*				
Taxus baccata L.	+	+	+	Ebert, Tubeuf, Söderberg
T. canadensis Marsh.	+	+	+	Söderberg
Torreya californica Torr.	+	+	+	Söderberg
T. nucifera (L.) Sieb. et Zucc. . .	+	+	+	Tubeuf, Söderberg

Tabell II. Chlamydospermae, endosperminnehåll.

	Stärkelse	Aleuron	Olja	Förf.
Klass: ***Gnetinae***				
Ordning: ***Ephedrales***				
Fam. *Ephedraceae*				
Ephedra altissima Desf.	+	+	–	Burgerstein
E. alt. v. *algerica* Stapf	+	+	–	Söderberg
E. americana Humb. et Bonpl. v. *andina* (Poepp.) Stapf	+	+	–	Söderberg
E. distachya L.	+	+	–	Söderberg
E. fragilis Desf. v. *campylopoda* (C. A. Mey.) Stapf	+	+	–	Burgerstein, Söderberg
E. minuta Florin	+	+	–	Söderberg
Ordning: ***Welwitschiales***				
Fam. *Welwitschiaceae*				
Welwitschia mirabilis Hook. fil. . .	+	+	+	Söderberg
Ordning: ***Gnetales***				
Fam. *Gnetaceae*				
Gnetum Gnemon L.	+	–	–	Burgerstein
G. nodiflorum Brongn.	+	–	–	Söderberg

sina stora frön, medan *P. nivalis* Hook. inom undersektionen D och *P. dacrydioides* A. Rich. i *Dacrycarpus*-sektionen jämte stärkelse även föra aleuron och olja i sina betydligt mindre frön. Fröna av *P. andinus* Poepp. från Kilmacurragh på Irland och *P. macrophyllus* D. Don från Jardim Botanico da Universidade de Lisboa saknade både embryoner och endosperm, vilket tyder på partenospermi hos dessa båda arter.

Om familjen *Cupressaceae* skriver Pilger (1926) på sid. 373: »Das Nährgewebe enthält fettes Öl und Aleuron». Detta påstående gäller även om familjen *Taxodiaceae* och därmed om hela ordningen *Cupressales* med två mycket märkliga undantag. Stärkelse finnes nämligen hos *Heyderia decurrens* (Torr.) K. Koch [= *Libocedrus decurrens* Torr.] och *Austrocedrus chilensis* (D. Don) Florin et Boutelje [= *Libocedrus chilensis* D. Don].

Cephalotaxus-släktet, som av en del forskare föres till klassen *Coniferae* och av andra till klassen *Taxinae*, har liksom *Taxus* och *Torreya* stärkelse, aleuron och olja i sina frön.

Vid mina undersökningar har jag konstaterat en mycket stor variation i barrträdsfröoljornas förhållande till osmium och sudan,

och helt säkert skulle en stort upplagd kemisk analys av fröoljorna kasta nytt ljus över gymnospermernas fylogeni.

Tabell II visar, att de enligt FLORIN (1931) och andra forskare mycket isolerade chlamydospermfamiljerna *Ephedraceae*, *Welwitschiaceae* och *Gnetaceae* även i avseende på endosperminnehållet äro väl skilda. Stärkelsekornen äro hos *Gnetum* mycket stora. De äro även rätt stora hos *Ephedra*, som även bildar aleuron i fröna. *Welwitschia mirabilis* HOOK. fil. för både aleuron och olja samt ytterst små stärkelsekorn, vilka i litenhet överträffa till och med stärkelsekornen hos *Torreya* och *Taxus*. Embryonerna hos *Welwitschia* äro stärkelsefria.

Bergianska trädgården, Stockholm 50, i mars 1954.

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EN SÖRMLÄNDSK HAGTORNSSKOG OCH NÅGRA ORD OM CRATAEGUS-FORMERNA I SÖDERMANLANDS KUSTLAND.

av

MÅNS RYBERG.

Allt som oftast bryta lövdungar av mot den förhärskande barrskogen eller den odlade jorden i det sörmländska kustlandet. Björk, ek, ask, al eller asp äro de viktigaste trädslagen. Ibland uppträder varje art för sig, ibland förekomma flera arter tillsammans. Särskilt artrik är den ädla lövskogen, lunden, som inte är så ovanlig i dessa trakter. I denna växa många trädslag utöver de ovan nämnda men mestadels som underordnade inslag. Stundom kunna dock hela skogsdungar bestå av en eller flera arter, som annars spela en obetydlig roll i kvantitativt hänseende.

Ett vackert exempel på detta förhållande erbjuder hagtornsskogen på den s. k. Furuholmen 3 km söder om Nynäs i Bälinge socken av Södermanlands län. En halvö av 1 km längd skjuter där ut från land och skiljer två fjärdar, Trobbofjärden och Tvären, från varandra. Utefter hela sin längd är denna halvö 500—600 m bred utom i det sydvästra hörnet, där en sank äng förbinder halvöns huvuddel med en låg men bergig holme. Den sammanlagda bredden uppgår där till omkring 1 km. Holmen har först i sen tid blivit förenad med fastlandet. På lantmäterikartor av 1678 och 1685 är den ännu omfluten av vatten, men 1842 framträder ungefär samma bild som i våra dagar.

Lövskogen har ganska stor utbredning vid Trobbofjärden, även om den har blivit mer och mer uppblandad med barrträd. Läget invid ett stort gods med medeltida anor har säkerligen här som annorstädes haft sin betydelse för de ädla lövträdens förekomst. Det är inte utan att de partier som skola skildras här ha mer tycke

av park än av beteshage. 1600-talskartornas »djurgård», 1842 betecknande nog degraderad till »kohage», låg dock ett par km längre västerut.

Halvöns huvuddel är till största delen klädd med barrblandskog. Särskilt i väster och söder blir lund-inslaget påfallande starkt med björk, ek, lind, ask, al och söderut hassel som viktigaste element. Apel och hagtorn påträffas i enstaka exemplar. Markfloran är ganska växlande utan att hysa några mer anmärkningsvärda arter.

Ängen i sydväst är fortfarande så sank att man knappast kan gå över torrskodd vid högvatten. Flera olika bälten kunna urskiljas, karaktäriserade av vass, *Scirpus uniglumis*, *Agrostis*-arter och *Triglochin palustre*. Holmen på västra sidan ängen tilldrar sig det största intresset. Den är i huvudsak låg men fasta berget, bestående av gnejs, går på flera ställen i dagen. Det i stort sett glesa trädbeståndet har en annan sammansättning än på halvön i övrigt. Lövträd förhärska. Tre arter dominera: al, apel och hagtorn. Mot stranden bildar alen slutna dungar eller ridåer. På torrare mark överväga de båda andra träden. Dessutom uppträda andra arter, bl. a. tall, gran, rönn och getapel (*Rhamnus catharticus*). Det glesa trädbeståndet ger en ängsartad prägel åt örtfloran, som på torrare mark uppvisar för ört- och klippbackar utmärkande arter, *Saxifraga granulata*, *Sedum*-arter m. fl. I fuktigare svackor märkas å andra sidan lundväxter såsom *Ranunculus Ficaria*, *Adoxa moschatellina* och *Cardamine bulbifera*.

Skogen är säkert starkt kulturpåverkad på hela halvön. Särskilt påtagligt är detta i söder, där den får en nästan parkartad karaktär. Lantmäterikartor ge dock ingen annan upplysning än att skogen har varit »betesmark», »backar» eller mot väster »äng». På en karta av 1888 äro små lador utritade på flera håll och det är troligt att slåtter har förekommit i mycket större utsträckning tidigare. Vid de tillfällen som jag har besökt lokalen har varken slåtter eller bete förekommit och de flesta gärdesgårdarna voro till yttermera visso nedfallna. Påfallande var också att skogen, hagtornsholmen inberäknad, inte hade det utseende som följer med långvarigt bete och som utmärker så många lundområden i kustlandet. Däremot förekommer mycket villebråd, såsom fasan, älg och rådjur, och olika åtgärder till det vildas utfodring och skydd ha vidtagits. Fråga är dock om dessa ha haft någon betydelse för hagtornens frekvens, eftersom hagtornsträden i regel ha uppnått en betydande ålder. Snarare vill man tro, att de ha kunnat växa upp utan alltför stark konkurrens med andra trädslag, och utan att lida några men av ett intensivt

Fig. 1. Södermanland, Bälinge s:n, Nynäs, hagtornsträd på södra delen av »Furuholmen». Utsikt över den i texten nämnda ängen mot öster. 17.4. 1949.

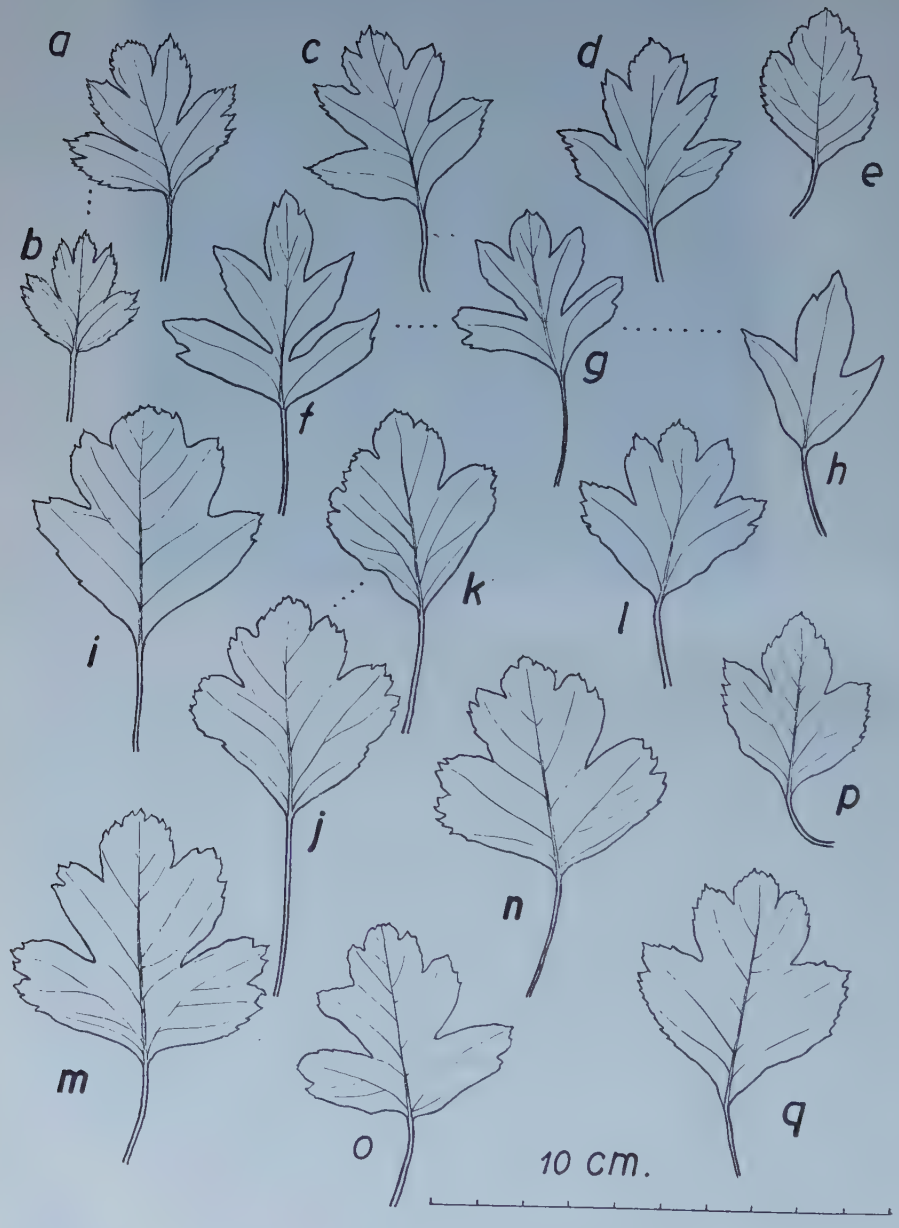
bete. Raunkiær (1925) framhåller nämligen, att ungplantor knappast ha någon chans att komma upp i Köpenhamns Dyrehave annat än på de ställen som äro skyddade för djurens åverkan. (Följden av de vilda djurens bete vid Nynäs kan man däremot säkert bortse ifrån.)

Hagtornen är mycket talrik. Någon noggrann beräkning av trädens antal har ej gjorts men de kunna uppskattas till mellan 50 och 100 stycken. På sina håll finnas rena bestånd. Så gott som alla individ ha trädform (fig. 1, 2). Åtskilliga av träden ha redan sett sin bästa tid och deras vresiga kronor äro till stor del döda men andra befinna sig ännu i full utveckling. På några exemplar mättes omkretsen vid brösthöjd. Detta mötte vanligen ingen svårighet, eftersom stammen kan vara rak och grenlös upp till ett par m ovanför marken. Värre ställde det sig naturligtvis med träd av den typ som jag har avbildat i annat sammanhang (Ryberg 1952, s. 316). Stammåtten äro inte särskilt anmärkningsvärda, hagtornsträd med en omkrets av flera gånger här angivna siffror ha uppmätts i andra delar av landet. Det är fastmer antalet träd som imponerar vid Nynäs. Det största uppmätta trädet mätte 123 cm i omkrets. Andra antecknade mått voro 112, 94 och 83 cm. Över 50 cm är regel. Höjden kan uppskattas till mellan 5 och 10 m i genomsnitt (jfr. fig. 1). Samtliga träd till-

Fig. 2. Södermanland, Bälinge s:n, Nynäs, tät hagtornsdunge på mellersta delen av »Furuholmen». 30.7. 1951.

höra samma art och äro anmärkningsvärt likformiga. De bära tydligt sågade blad med relativt grunda inskärningar mellan de rundade flikarna (fig. 3 *j—n*). Bladformen varierar en hel del t. o. m. på samma gren men detta är en normal företeelse hos våra hagtornar liksom att bladen på kort- och långskott visa avsevärda skillnader (jfr fig. 3 *l* och *m*). De på fig. 3 avbildade bladen kunna därför bara ge en ungefärlig uppfattning om bladens utseende hos resp. individ. Jag har emellertid strävat efter att avbilda blad med samma läge på skotten, eftersom bladen bli allt mindre flikiga mot skottens spetsar. Bäst utvecklade bruka de vara vid skottens mitt. Nynästräden kännetecknas vidare av en långsträckt frukt utan hår vare sig på själva frukten eller på fruktskaftet. Frukterna ha utåt- eller bakåtböjda foderflikar (fig. 4 *j—m*), som äro något längre än hos *C. monogyna* och *C. oxyacantha* (fig. 4 *g—h*), men ej så långa och spetsiga som hos många hagtornar från andra lokaler i trakten.

Närmast överensstämmer denna hagtornsform med *C. curvisepala* Lindm. och tillhör alltså den grupp som normalt har bara ett stift i blommorna. Den två- eller trestiftade *C. oxyacantha* har ej iakt-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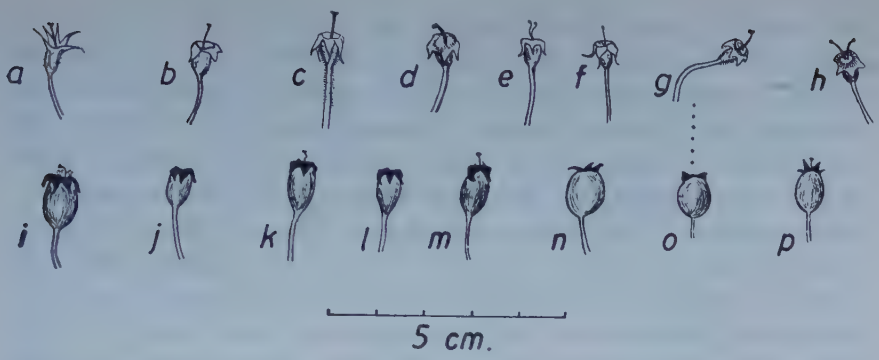

Fig. 4. Fruktämnen och frukter med kvarsittande foder av *Crataegus*-former från östra Södermanland.
a, *C. calycina*, Söräng, Tullgarn, Hölö s:n; *b*, *C. monogyna* (övergångsform), Tullgarns park, Hölö s:n; *c*, *C. curvisepala*, Enskär, Bälinge s:n; *d*, *e*, *C. curvisepala* (ev. hybrid med *C. oxyacantha*), Näset, Hölö s:n; *f*, *C. curvisepala*, Kråkskär, Sorunda s:n; *g*, *o*, *C. monogyna* (ej odlad), 300 m söder Skogstorp, Hölö s:n; *h*, *C. oxyacantha*, Näset, Hölö s:n; *i*, *C. curvisepala*, Snöholmen, Trosa stad; *j*, *k*, *l*, *m*, *C. curvisepala*, Nynäs, Bälinge s:n, ex. 1, 2, 3, 4; *n*, *p*, *C. curvisepala*, Gillbergsvik, Trosa-Vagnhärads s:n.

tagits av mig vid Nynäs men kan mycket väl förekomma, eftersom den hör hemma i lundarnas vegetation.

Innan Nynästräden jämföras med andra hagtornar från grannskapet kan det vara lämpligt att som hastigast se på den i Skandinavien brukliga artavgränsningen. Ursprungligen betraktades alla hagtornar som en art, *C. oxyacantha* L. Sedermera begränsades denna art till att omfatta de typer som ha två—tre stift (i normala fall) och de enstiftade arterna innefattades i *C. monogyna* Jacquin (1775, tab. 292, f. 1). En tredje art, likaledes med ett stift, utbröts med *C. calycina* Petermann (1849, s. 176). Såväl *C. monogyna* som *C. calycina* beskrevos på utomskandinaviskt material. 1904 (s. 135—37) tog Lindman upp frågan om de svenska hagtornsformernas ställning och identifierade somliga med den dittills förbisedda *C. calycina*. I Svensk fanerogamflora (1918, s. 305—07) beskrev eller omnämnde han ytterligare tre arter, *C. Palmstruchii* (en *oxyacantha*-typ), *C. lagenaria* Fisch. et Mey. (i 1926 a = *C. microphylla* K. Koch,

Fig. 3. Blad av *Crataegus*-former från östra Södermanland. Samtliga blad tagna från mitten av blomskott (utom *m*). Blad från samma individ förenade nedan genom —. *a—b*, *C. calycina*, Söräng, Tullgarn, Hölö s:n; *c*, *C. curvisepala*, Snöholmen, Trosa stad; *d*, *C. curvisepala*, Enskär, Bälinge s:n; *e*, *C. oxyacantha*, Näset, Hölö s:n; *f—h*, *C. monogyna* (ej odlad), 300 m söder Skogstorp, Hölö s:n; *i*, *C. curvisepala*, Kråkskär, Sorunda s:n; *j—k*, *C. curvisepala*, Nynäs, Bälinge s:n, ex. 1; *l—m*, *C. curvisepala*, Nynäs, Bälinge s:n, ex. 2 (*m* = blad från långskott); *n*, *C. curvisepala*, Nynäs, Bälinge s:n, ex. 3; *o*, *C. monogyna* (övergångsform), Tullgarns park, Hölö s:n; *p*, *q*, *C. curvisepala* (ev. hybrid med *C. oxyacantha*), Näset, Hölö s:n.

en sydsvensk *monogyna*-form) och *C. curvisepala*. Det är den sistnämnda som är av intresse i detta sammanhang. A. I. Pojarkova (1939, s. 450) anger *C. curvisepala* som synonym till *C. kyrtostyla* Fingerhuth (1829, s. 372—74). Hennes figur av denna art är obestridligt lik *C. curvisepala* (betydligt mer lik än Fingerhuths egen bild!), men jag anser det ändå vanskligt att betrakta dem som identiska med tanke på den stora variationen inom släktet, i synnerhet som de båda formerna äro beskrivna från helt olika områden. Typexemplar av *C. kyrtostyla* saknas också enl. Pojarkova. De tre »arterna» *C. monogyna* s. s., *C. calycina* och *C. curvisepala* skilja sig främst i följande avseenden (jfr Lindman 1904, fig. s. 135; 1918 eller 1926 a, fig. 189; 1926 b, Tavl. 613; Lid 1952, fig. 196): *C. monogyna* har m.e.m. flikiga blad med svagt sågade till helbräddade flikar åtskilda av tämligen djupa inskärningar och äggrunda frukter med korta, bakåtböjda foderflikar. Jacquins bild visar en växt med detta utseende. *C. calycina* har spetsiga, tätt och vasst sågade bladflikar åtskilda av trånga inskärningar och cylindriska frukter med smala, upprätta foderflikar (jfr s 509). *C. curvisepala* har något mindre vasssågade blad med mer nedlöpande bas. Gränsen mot föregående arter kan dock vara diffus. Frukterna äro äggrunda till avlånga med långspetsade, bakåtriktade foderflikar.

Lindmans uppfattning har inte blivit allmänt godtagen. Hegi refererar i förbigående till honom och bifogar avbildningen från Svensk fanerogamflora (som fig. 1061) men avhåller sig från att försöka identifiera några av de mellaneuropeiska formerna med Lindmans arter. Av hithörande former ger Hegi arträtt åt *C. monogyna*. Hans bild av denna visar en växt med långskottsblad som hos *C. monogyna* s. s. men med kortskottsblad som stämma bättre in på *C. curvisepala*. Av nyare författare följa bl. a. Almquist (1929), Almquist & Asplund (1937), Nordhagen (1940), Sterner (1938) och Lagerberg (1948) Lindman, medan t. ex. Hylander (1941), Hultén (1950) och Lid (1952) endast taga upp *C. oxyacantha*, *C. monogyna* och *C. calycina*. I den sistnämnda arten inbegrips då *C. curvisepala*. Studerar man äldre floror, t. ex. Thedenius (1871) eller Hartman (1879), framgår av deras beskrivningar att *C. monogyna* till största delen måste avse *C. curvisepala* Lindm.

Släktet *Crataegus* har i många delar av sitt utbredningsområde gjort sig känt för sin synnerligen starka variabilitet. Särskilt ryktbar för sin mångformighet har hagtornsfloran i S:t Lawrenceflodens dalgång blivit. Under de senaste 100 åren ha bortåt 900 »arter» om

inte flera beskrivits från detta område. Deras natur är väl ännu ganska omtvistad (jfr Cain 1944, s. 384—86, Anderson 1949, s. 80), men ett faktum är att artantalet har stigit med explosionsartad hastighet och att denna ökning har gått hand i hand med kulturens ökade omformning av landskapet, varigenom växtplatser skapats för former som med stor sannolikhet aldrig skulle ha kunnat hålla sig kvar i annat fall. Ett liknande exempel erbjuda *Iris*-arterna från Mississippis delta.

I Europa har artbildningen inte fortskridit i samma takt. Läser man t. ex. Hegis redogörelse för Centraleuropas *Crataegus*-former, finner man likväl att även de europeiska arterna, främst *C. monogyna* s. l., visa en mycket stark variation, ehuru de flesta typerna inte ha blivit betraktade annat än som »former» eller »varieteter». Denna mångformighet stämmer bra med det intryck som man får av den inhemska hagtornsfloran.

Även om vi begränsa oss till de former som växa utefter Sörmlandskusten, komma dessa att uppvisa en ganska heterogen samling men kunna i de flesta fall fördelas på grupper motsvarande Lindmans arter. En säker art är *C. oxyacantha* (fig. 3 *e*, 4 *h*). Utav de enstiftade arterna märkas individ vilkas blad överensstämma med florornas *C. monogyna* s. s. (fig. 3 *f—h*; enl. Lindman 1926, fig. 189, och att döma av Lindmans herbariematerial i Riksmuseet troligen även fig. 3 *o*). Denna hagtornstyp har korta, utåtböjda foderflikar (fig. 4 *g*, *o*, ev. *b*) och förekommer oftast odlad eller förvildad. Särskilt används den till häckar och brukar då ha djupt flikiga blad på långskotten. Detta blir så mycket mer påfallande som långskott komma att utvecklas i onormalt stor omfattning efter beskärning. Här och var växa också buskar (ev. träd) med smala, m. e. m. upprätta foderflikar. De ha identifierats med *C. calycina* Peterm. (fig. 3 *a—b*, 4 *a*). Den förhärskande typen representeras emellertid av en mångformig samling som inte med fördel kan stoppas in i någon av ovanstående arter (fig. 3 *c*, *d*, *i —n*, *p—q*, 4 *c—f*, *i—n*, *p*). Till utseendet äro dessa hagtornar m. e. m. intermediära mellan *C. monogyna* och *C. oxyacantha*. Särskilt träden från Näset vid Tullgarn (fig. 3 *p*, *q*, 4 *d*, *e*) förete stora likheter med den senare arten (jfr s. 508). Samtliga karaktärer som nämnts på s. 505—506 i samband med Nynästräden variera och kunna kombineras på olika sätt. Ej sällan äro foderflikarna längre och bladen spetsigare.

Variationen kan utsträckas till många andra egenskaper men de här nämnda bära tillräckligt vittnesbörd om mångformigheten.

Vissa karaktärer synas dock förekomma tillsammans och härigenom är det möjligt att urskilja en grupp som kan betecknas som *C. curvisepala*. Det skall dock villigt erkännas, att flera exemplar kunna ha karaktärer från olika arter och att det kan vara svårt att upprätthålla en distinkt gräns mot framför allt *C. monogyna*. Även inom ett och samma bestånd kan variationen vara avsevärd. I synnerhet *curvisepala*-typen synes vara kulturgynnad. Der förekommer utom i lundar och på skärgårdens holmar särskilt i snåren kring gårdarna, i hagar och på dylika ställen. Detta visar en viss likhet med förhållandena i Nordamerika, fastän mindre tydligt.

En viss ledtråd i fråga om denna artförbistring ger en avhandling av Raunkiær (1925) i vilken han har genomfört en statistisk analys av det stora hagtornsbeståndet på Eremitagesletten i Köpenhamns Dyrehave. Där växte både ren *C. oxyacantha* och typisk *C. monogyna*. Flertalet exemplar voro dock intermediära i en eller flera av de fyra karaktärer som han hade valt ut för sin analys. Många kombinationer funnos, men de flesta kunde föras till en grupp som till sist betecknades med ett särskilt namn, *C. eremitagensis* Raunkiær. Även ett par andra kombinationer voro så talrika, att de blevo namngivna. Mycket tyder på att dessa intermediära former kunde vara hybrider mellan *C. oxyacantha* och *C. monogyna*. Bl. a. växlade stiftantalet från individ till individ och från blomma till blomma på samma individ. Nu stämmer visserligen inte Raunkiærs *C. monogyna* (Raunkiær, fig. 12, 14) till alla delar med den typiska bilden av denna art. Sålunda är fodret betydligt mer långspetsat och bladen påminna mest om det på fig. 3 *c*. Detta betyder emellertid mindre. Väsentligast i detta sammanhang är förekomsten av en serie mellanformer, vilket ju är en tydlig parallell till förhållandena hos oss. Det kan vara värt att framhålla att hos exemplaren från Näset vid Tullgarn i Hölö sn. äro bladen av en liknande intermediär typ som hos Raunkiær (fig. 3 *p*, *q*; Raunkiær fig. 12). Vidare växlar antalet stift i olika blommor (fig. 4 *d*, *e*) och pollenet är till omkring $^1/_4$ letalt hos de två undersökta individen. Även på andra lokaler är pollenets kvalitet ojämn. En preliminär undersökning av pollenet hos ett antal hagtornar från Sörmlandskusten har visat, att avsevärda differenser föreligga i pollenets utveckling hos olika individ och på olika lokaler.

Förmodligen är det svårt att komma mycket längre på den väg som Raunkiær slagit in på. För att nå säkra resultat beträffande våra hagtornars uppkomst och systematiska ställning fordras såväl

embryologisk-cytologiska undersökningar som experimentella studier med isoleringar, korsningar m. m. Bara en sådan fråga som om *Crataegus* i Skandinavien är sexuell eller apomiktisk har den största betydelse. Innan sådana undersökningar ha blivit utförda, är det dock fråga, om det inte vore lämpligast att bibehålla de lindmanska arterna som ett provisorium för de mellanformer som kunna bilda så karaktäristiska element i landskapet som vid Nynäs och på många andra håll i södra och mellersta Sverige. I synnerhet gäller detta för *C. curvisepala* oavsett dess i åtskilliga hänseenden diffusa ställning. Att som vissa författare betrakta alla intermediära former som tillhörande *C. calycina* Peterm. finner jag mer tveksamt. För det första är Petermanns originaldiagnos mycket intetsägande utom i ett enda avseende. Den lyder i sin helhet (1849, s. 176): »Kelch zipfel—lanzettlich, verlängert, auf der Frucht aufrecht» (i motsats till *C. oxyacantha*). Hans figur (Taf. 26, fig. N) visar enbart frukten. För det andra är detta raka motsatsen till vad som utmärker *C. curvisepala*. Visserligen kunna foderflikarna hos exemplar av *curvisepala*-typ vara olika ställda t. o. m. på blommor eller frukter av samma individ och de kunna vara m. e. m. utåtriktade (jfr fig. 4 *n* och *p* med övriga i raden), men de ha inte den form som Petermann uppger. För det tredje är denna frukttyp mycket ovanligare än *curvisepala*-typen. För de individ som äga frukter i överensstämmelse med Petermanns definition kan man bibehålla namnet *C. calycina* i brist på bättre. Med tanke på den starka variationen inom släktet är det dock ovisst, om de verkligen tillhöra hans art, som ju är beskriven från en helt annan del av Europa.

Den nordiska hagtornsfloran är sålunda i stort behov av en grundlig undersökning. De rika *Crataegus*-förekomsterna i många delar av Sverige, t. ex. i östra Svealand, erbjuda ett värdefullt material och ett stort intresse tilldraga sig bestånd av den omfattning som möter vid Nynäs.

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EMBRYO-SAC DEVELOPMENT IN EPIPOGIUM APHYLLUM.

BY

KARL AFZELIUS.

The saprophytic orchid *Epipogium aphyllum* Sw. is a very interesting species because of its reduced habit and sporadic occurrence, often with an interval of several years. It may have an entirely subterranean existence for a long time, propagating itself by means of corallaceously branched, wholly rootless rhizomes. The fructification is said to be very slight (cf. e.g. Ziegenspeck 1936). The species has a large distribution area, comprising extensive parts of Europe and Siberia. It occurs sporadically in almost the whole of Sweden and seems to be most abundant in the province of Jämtland in central Sweden. That is the province in which flowering specimens are most likely to be met with every year. As far as I am aware, no information is available in the literature with regard to the embryo-sac development and chromosome number in *Epipogium*, and it is hoped that the following communications will to some extent fill that gap. The material upon which the present investigation is based derives from Jämtland, and I wish to take this opportunity of expressing my thanks to Dr. H. Winberg, who sent me living plants, and to Dr. H. Stenar, who placed at my disposal ample fixed material, mainly treated with Zenker's fluid. Dr. Stenar had pollinated several specimens and fixed the ovaries after a period of 1—8 days; this made it possible to follow the fertilization and commencement of the embryonal development.

The embryo-sac development appears to take place very rapidly. The young ovule has the tenuinucellate structure characteristic of the orchids, with an archesporial cell which grows out direct into an embryo-sac mother-cell. The ovule, however, is more reduced

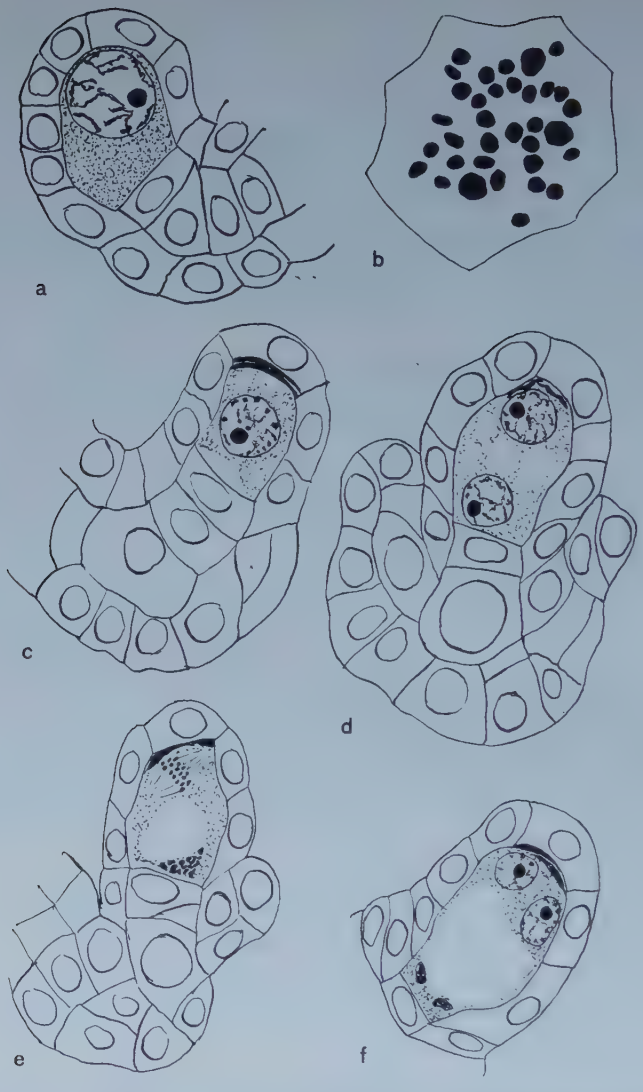

Fig. 1. *Epipogium aphyllum*. *a*, Young ovule with the nucleus of the embryo-sac mother-cell in the initial prophase. *b*, First metaphase in embryo-sac mother-cell showing 34 chromosomes. *c*, Tetrad with uninucleate embryo-sac and two disintegrating cells. The only integument begins to develop. *d*, Binucleate sac. *e*, Second division in the sac. The chalazal spindle with crowded chromosomes. *f*, Four-nucleate sac.

than usual and at first shows no trace of integument (Fig. 1 a). Only one integument develops, and this does not begin to appear until the tetrad division is completed (Fig. 1 c and d). When the embryo-sac is organized it has still not grown up over the nucellus and formed a

micropyle (Fig. 2 d). On the other hand, the epidermis of the nucellus long remains functional as a protective layer round the embryo-sac and does not disintegrate as quickly as is usually the case. A characteristic feature of the chalazal region is the formation of a large cell with a very large nucleus (Fig. 1 d, etc.).

The tetrad division follows the same course as in many other orchids. Thus the embryo-sac mother-cell gives rise to two cells, the outer one of which quickly degenerates, while the basal one divides once again into an outer, which also soon dies, and a basal cell, which develops into the embryo-sac. In a few cases it has been possible to count the number of chromosomes in the heterotypic division, and the haploid number is 34 (Fig. 1 b). Three of the chromosomes are much larger than the others. The haploid number in *Epipogium* coincides with the diploid in *Cephalanthera erecta* and *C. falcata* (Miduno 1938). On the other hand, *C. Shizuoi* has $2n = 32$, which agrees with $n = 16$ in *C. longifolia* (Afzelius 1943, Hagerup 1947). A similarity between *Epipogium* and *Cephalanthera* is that three gemini are much larger than the others, and these undoubtedly correspond to the six very long somatic chromosomes that Miduno found in the species of *Cephalanthera* which he examined and to the four or six similar ones which he established in *Epipactis*. The number $n = 17$ also occurs in *Listera ovata*, a species studied by many botanists and extremely variable in respect of its chromosome number; here e.g. Tuschnjakova (1929) demonstrated the numbers $n = 16$, 17 and 18, A. and D. Löve (1944) $2n = 34$ and 36, and Hagerup (1947) $n = 17$ and 18. The number 17 or multiples of this have hitherto, as far as I am aware, only been found in the genera *Cephalanthera*, *Epipogium* and *Listera*.

In a single ovary four cases of two archesporial cells were met with, two of which are illustrated in Fig. 2 a and b. Fig. 2 a shows a case in which the two cells lie side by side and have given rise to binucleate embryo-sacs. In Fig. 2 b the upper one has already divided, while the lower one is in the initial prophase.

The primary embryo-sac nucleus divides into two; these take up positions at each end of the embryo-sac in the usual way, after which a central vacuole is formed between them (Fig. 1 d). The outer nucleus by two divisions gives rise to four nuclei, which constitute a typical egg apparatus and an upper polar nucleus (Fig. 2 c). Apparently the chalazal nucleus divides but rarely into two, and these are very small from the beginning (Fig. 1 f). Sometimes a

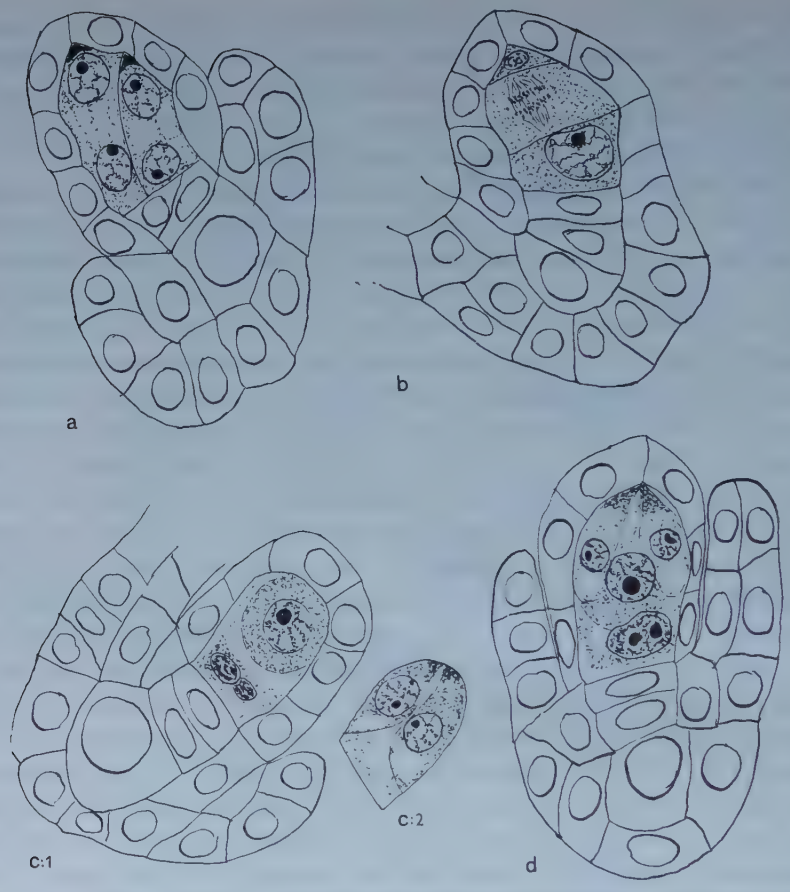

Fig. 2. *Epipogium aphyllum*. *a*, Nucellus with two binucleate sacs. *b*, One embryo-sac mother-cell in prophase and one in tetrad division. *c*, Mature sac, in *c*: 2 the synergids. *d*, Mature sac with only one chalazal nucleus.

division certainly commences, but the spindle looks degenerate with crowded chromosomes (Fig. 1e) and probably cannot form two normal nuclei. Nearly all the organized embryo-sacs exhibit at the base only two nuclei (Fig. 2c), one of which is larger than the other and seems viable and is undoubtedly the upper polar nucleus, while the other is always smaller and often appears to be dying and must be interpreted as a chalazal nucleus. Usually the base of the embryo-sac contains one large nucleus only (Fig. 2d). It has been impossible to determine whether this is a fusion product of two or whether the original basal nucleus has disappeared, leaving the polar nucleus alone. In any case no antipodes are ever formed, the embryo-sac

always being strongly reduced at the base and mainly filled up by the egg apparatus. The embryo-sacs are already mature and ready for fertilization before pollination has taken place.

The embryo-sac in *Epipogium* exhibits the same reduction in the chalazal region as is characteristic for many orchids. It is usual, when the number of divisions is normal, for three antipodal nuclei to be constituted, it is true, but these soon disintegrate without having previously formed antipodal cells. Occasionally the last division fails to take place in the basal region, so that some embryo-sacs only become 6-nucleate, as in e.g. *Bulbophyllum neilgherrense*, *B. mysorense* and *Geodorum densiflorum* (Swamy 1949), *Spiranthes australis* (Baranow 1916), *Gyrostachys cernua* and *G. gracilis* (Pace 1914), *Platanthera chlorantha* and *P. obtusata* (Afzelius 1922) and several others. In some cases a 6-nucleate embryo-sac may arise as a result of the two basal spindles fusing in the third division, as in e.g. *Epipactis pubescens* (Brown and Sharp 1911). Five-nucleate embryo-sacs, caused by both divisions in the base failing to take place, occur sporadically in e.g. *Gyrostachys* (Pace 1916), *Orchis Morio* (Afzelius 1916) and *Platanthera* (Afzelius 1922). Constant 6-nucleate embryo-sacs in consequence of the third division in the chalazal region having entirely ceased, are not infrequent and are met with in e.g. *Broughtonia sanguinea*, *Corallorhiza maculata* and *Phajus grandifolius* (Sharp 1912), *Serapias pseudocordigera* (Baranow 1916), *Chamorchis alpina* and *Oncidium praetextum* (Afzelius 1916), and *Calypso bulbosa* (Stenar 1940). Interesting conditions are met with in *Listera ovata*, which according to Tuschnjakova (1929) forms three rapidly degenerating antipodal nuclei, while this species according to Hagerup (1947) never has antipodes and "the mature embryo sac merely seems to contain 4 nuclei". In view of the great variation often exhibited by one and the same species, it is not inconceivable that this is a case of local races in different stages of reduction, as the material studied by Tuschnjakova certainly derives from Russia, and the plants examined by Hagerup were from Denmark.

My investigation material comprises no early stages of pollen development. On the other hand, it contains several ripe stamens, which show that the pollen is fully normal and abundant.

Three days after pollination the ovaries contain numerous pollen tubes, and the male nuclei have almost everywhere already penetrated into the embryo-sacs; fusion between a male and a female nucleus has often already taken place. Eight days after pollination

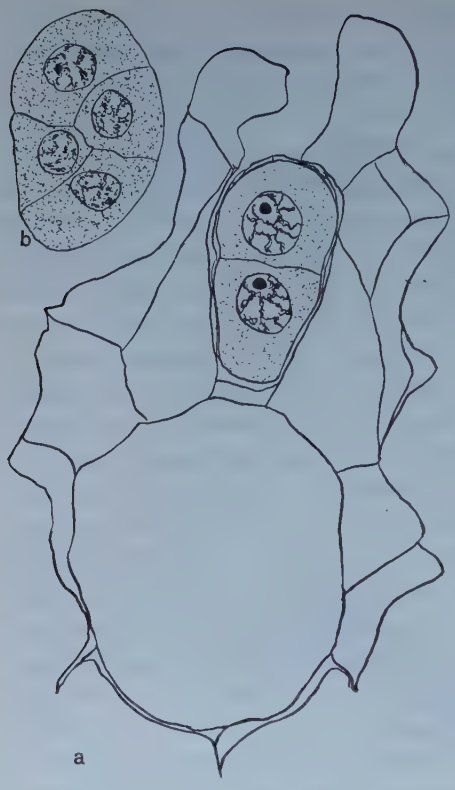

Fig. 3. *Epipogium aphyllum*. *a*, Young seed with two-celled embryo. *b*, Four-celled embryo.

2- and 4-celled embryos have already been formed. Fig. 3 shows an ovule at this stage, containing a 2-celled embryo. The integument has now grown up over the embryo, and the epidermis of the nucellus has begun to disintegrate. The ovular cells have become large and inflated, and the large chalazal cell forms a large cavity, which should help to make the seeds particularly light. Evidently no suspensor is developed, the embryo being of the same type as in *Listera*, *Neottia* and *Spiranthes* according to Swamy (1949).

In respect of embryo-sac development and embryo structure, *Epipogium* appears to come closer to *Neottineae* than to *Cephalantherineae*, to which Ziegenspeck (1936) assigns the genus in his systematic classification.

An examination of many ovaries shows that the seed formation is rather poor in the material studied by me. In a cross-section only thinly scattered embryos are visible instead of the enormous quantities that are usually found in the majority of orchids.

The strong reduction which is so characteristic of the vegetative parts of *Epipogium* is also typical in the case of the seed development. The only integument which is formed does not attain its full size, as we know, until after fertilization, and its office is carried out beforehand by the epidermis of the nucellus, which ordinarily disappears early but here remains alive until the integument has developed. The very slight seed formation despite careful cross-pollination also indicates a weakening of the sexual reproduction capacity. In this case it is hardly likely to be due to the specimen belonging to the same clone, and to the poor seed formation being thus connected with the more or less pronounced self-sterility which occurs in many orchids. According to the observations made by KIRCHNER and ROHRBACH and cited by ZIEGENSPECK, pollination would appear to be infrequent in nature and self-pollination out of the question. KIRCHNER examined some dehiscent capsules (ZIEGENSPECK 1936 p. 166) and only found dried ovules in them, no mature seeds. Some of the living plants sent to me from Jämtland had occasional swollen ovaries, which nevertheless only contained dried ovules. Observations in nature of insect visits to the flowers have been made by ROHRBACH (ZIEGENSPECK l.c. p. 164), and pollination is undoubtedly likely to occur even if it is very infrequent, and some investigators (ZIEGENSPECK l.c. p. 166) have found capsules containing an abundance of seeds. These cases, however, derive from Central Europe, and there the species may conceivably behave differently than it does in such a northerly province as Jämtland where, as mentioned above, pollination seems to yield a poorer result than is common in the orchids. Sexual reproduction is likely to be of little significance for the propagation of the plant and helps to explain its great rarity. The spread of the plant is mainly assured in any case by the vegetative runners which are formed by the rhizome and which are nothing but strongly reduced and transformed flower stalks, and their various possibilities of development in different years contribute to the sporadic occurrence of the plant.

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APANS STEGE OCH PYRRHAS HÅR.

NÅGRA REFLEXIONER ÖVER BOTANISKA ARTNAMN MED TVÅORDSEPITET SAMT EN FÖRTECKNING ÖVER EN GRUPP AV SÅDANA.

AV

NILS HYLANDER.

Nyligen har 200-årsminnet firats av Linnés åtminstone ur praktisk synpunkt viktigaste verk, Species plantarum. Dess praktiska betydelse ligger däri, att man här för första gången har genomfört det system, som nu är allmänt gängse för växtarternas (liksom djurarternas) vetenskapliga benämningar, det s. k. binära systemet; för den skull har Species plantarum i den lagbok, som reglerar växternas vetenskapliga nomenklatur, tagits till utgångspunkt för denna. Detta innebär, att inga namn vare sig för släkten, arter eller andra systematiska enheter (eller taxa, som det nu heter) i verk publicerade före Species plantarum skola beaktas eller, om man så vill uttrycka saken, kunna göra anspråk på prioritet. Av praktiska skäl räknas båda delarna av Linnés verk som utkomna samtidigt; av opraktiska skäl har detta datum godtyckligt satts till 1 maj 1753.[1]

Vad innebär då denna binära artnomenklatur gentemot den förlinnaeanska namngivningsprincipen? Jämför man Species plantarum med något verk av endast obetydligt äldre datum, där arterna ordnats släktesvis, innebär ju redan denna anordning en väsentlig likhet genom det gemensamma accepterandet av detta grund-

[1] För alla andra böcker, tryckta under 1753, med växtnamn i måste man alltså leta ut exakt publiceringsdatum — något som man bekvämt skulle ha sluppit, om utgivningsdatum för Species plantarum fixerats till årets första eller sista dag, så som skett för ett par senare arbeten, vilka spela motsvarande roll av nomenklatorisk utgångspunkt inom ett par speciella växtgrupper, som undantagits från den generella bestämmelsen med Species plantarum som »starting point».

begrepp, om också Linné gentemot äldre författare avgränsade detta på ett långt klarare och — för att anakronistiskt anlägga moderna synpunkter — fylogenetiskt korrektare sätt. En följd av den äldre, vagare, ofta på systematiskt betydelselösa likheter byggande släktavgränsningen var också, att i en del fall småningom utformades ett egenartat namnsystem, där det ursprungliga namnet på ett släkte, som befunnits alltför heterogent, fått ett tilläggsord, ett attribut, varigenom vart och ett av de mera naturliga nya delsläktena blivit begåvat med ett tvåordigt namn, exv. *Centaurium majus* och *Centaurium minus*, motsvarande vad vi nu kalla resp. *Centaurea* och *Centaurium*. Just detta exempel finns kvar ännu i ett arbete, varifrån många nu gällande släktnamn räknas som giltigt publicerade, nämligen fjärde upplagan av Philip Millers The Gardeners Dictionary (1754), där eljes släktenas namn bildats så som alltid sker hos Linné. Hos denne utgörs släktnamnet konsekvent av ett ord — det må så vara, att detta egentligen kan vara sammandraget av två, såsom *Cornucopiae*.

Vad som sagts om Linnés striktare avgränsning av släktena gäller än mer i fråga om arterna, där även de bästa av Linnés föregångare hade mycket oklara principer rörande värdet av de artskiljande karaktärerna och i långt högre grad än Linné jämställde oviktiga, till dels helt tillfälliga avvikelser med vad vi betrakta som »riktiga» arter (vilket inte hindrar, att exv. bröderna Bauhin med sin intima fältkännedom om den mellaneuropeiska floran i åtskilliga fall riktigare avgränsade till denna hörande arter än Linné, som härvid fick bygga på litteraturkännedom). Antalet arter inom dessa släkten kunde liksom än i dag variera från en enda till många. I det förra fallet brydde man sig i den förlinnaeanska litteraturen ofta nog ej om att göra någon namnskillnad mellan släkte och art — med andra ord, släktnamnet fick beteckna även arten. Inom släkten med flera arter fogades däremot till släktnamnet en artskiljande fras på latin, växlande i längd från ett ord till många, alltefter behov — denna fras skulle nämligen, på samma sätt som våra nutida artdiagnoser, innehålla de skiljemärken, varigenom arten i fråga kunde särskiljas från de övriga i släktet. När nya arter tillkommo i detta, anknötos de ofta till tidigare kända genom att de försågos med ett namn, som blott genom något förtydligande tillägg avvek från ett tidigare; ev. måste ett eller annat av de tidigare också få ett sådant komplement. Namnskicket var alltså föga fixerat, ens i det formella, och till på köpet ytterligt obekvämt, redan för den tidens, i jämförelse med nutidens, högst begränsade antal av kända arter.

Linnés insats betydde en normalisering av arternas namnskick, i det att alla artnamn i princip blevo likartade; varje art fick, vare sig den var ensam av sitt släkte eller en av många, ett namn bestående av släktnamnet, åtföljt av vad vi nu kalla ett epitet (i dagligt tal men oriktigt ofta kallat artnamn) men som av Linné kallades *nomen triviale* — fastän Linné själv i registret till Species plantarum använder denna term i en något inskränktare betydelse.

Våra nuvarande nomenklaturregler (International Code of Botanical Nomenclature, Utrecht 1952) utdöma nu emellertid inte bara som »icke-existerande» alla namn av äldre datum än Species plantarum utan också som icke »giltigt publicerade» (»validly published») sådana artnamn av yngre datum, som icke äro bildade enligt det binära systemet, ja även sådana efter 1753 publicerade artnamn, som väl synas formellt vara av linnaeansk typ men som härröra ur arbeten, där Linnés binära princip ej genomgående tillämpas; dessa alltså blott av två ord bildade namn äro endast tillfälligtvis så korta, på grund av att den beskrivande frasen i dessa fall reducerats till ett enda ord och därigenom till typen blivit oskiljbar från ett epitet i linnaeansk stil. I stort sett kan man nämligen säga, att Linnés metod är en tvåordsmetod: första ordet är alltid släktnamnet, därefter följer epitetet, också bestående av ett ord.

Det sistnämnda håller dock ej alltid streck — redan i Species plantarum finnas talrika epitet, som bestå av två ord, i regel upptagna från äldre författare, där de tjänat som släktnamn eller som kombinerade art- och släktnamn i monotypiska släkten. Dessa epitet i Species plantarum äro emellertid enligt nuvarande regler lika giltiga som ettords-epiteten där, ja det är alltjämt tillåtet att bilda nya epitet bestående av två ord — eller av flera; det finns nämligen, särskilt bland svamparna, exempel på allmänt godtagna namn med treordigt epitet, ehuru försiktigtvis reglerna ingenting nämna därom. När nu endast artnamn bildade enligt den linnaeanska metoden äro tillåtna men å andra sidan denna senare inte utesluter bruket av tvåordiga (och treordiga) epitet, är det självfallet nödvändigt att veta vilka andra grunder, som äro avgörande för frågan, om ett epitet uppfyller den binära metodens fordringar eller ej. Vad säga våra regler därom? Platt intet! Detta är nu inte det enda fall, där koden bygger på grundbegrepp som inte definieras. Frågan borde ju ha lösts på den senaste kongressen i Stockholm (1950), men det förslag jag lämnat till en definition blev strypt i förväg, frågan försvann och är alltjämt olöst.

Likväl är denna brist på klar definition av begreppet epitet och dettas lagliga form beklaglig inte bara ur allmän ordningssynpunkt utan även rent praktiskt. För det första ha nämligen under senare år understundom tvåordsepitet bildats, vilka ej stämma med vad som i praxis kommit att betraktas som godtagbart namnskick. För det andra beror just på denna avvägning, huruvida ett antal artnamn av normal binär typ, vilka varit allmänt gängse, skola förkastas, därför att de faktiskt stamma från ett par arbeten, där artnamnen ej genomgående äro av denna typ. Jag syftar här på Gilibert's båda arbeten Flora Lithuanica (1781) och Exercitia Phytologica (1792), i vilka åtskilliga artnamn äro av den typ som följande exempel åskådliggöra: *Verbascum parvo flore*, *Jasione scabiosae capitulo*, *Dipsacus connato folio* (alla ur Flora Lithuanica), *Serapias tota alba*, *Mnium trichomanis facie* och *Hypnum tamarisci foliis* (de tre sista ur Exerc. Phytol.). Det synes mig odisputabelt, att dessa namn äro av klart förlinnaeansk (eller: icke-linnaeansk) typ och att därför arbetena i fråga enligt nomenklaturreglernas bestämmelser skola helt förkastas som källa för vetenskapliga artnamn. Detta förslag (som jag framställde 1945) har också fått understöd från flera håll, men något formellt beslut har ej fattats av vederbörande botaniska myndighet. Kanske kommer det på Paris-kongressen 1954.

Nu finns det säreget nog t.o.m. i Species plantarum några — 3, eller möjligen bara 2 — fall av dylika namn, vilka ej kunna förklaras annat än som förbiseenden och vilka mycket riktigt snart ändrades av Linné själv i överensstämmelse med normalt bruk; det gäller *Salvia afr*[*icana*]. *coerulea* (1762 ändrat till *S. africana*), *Salvia afr*[*icana*]. *lutea* (1762: *S. aurea*) samt *Apocynum fol. androsaemi*. Det sistnämnda epitetet skulle nu visserligen kunna tydas som *folium androsaemi* och därmed formellt vara jämnställt med andra godtagna och godtagbara tvåordsepitet, men den tolkningen förefaller dock högst osannolik; rimligen måste det tolkas som *foliis androsaemi*, så som tydligen antagits i nomenklaturreglerna (ehuru denna skrivning, som återfanns i 1930 års regler, nu övergetts till förmån för Linnés ursprungliga). Denna fras är ju av exakt samma typ som många av de hos Gilibert förekommande, av mig som »icke-linnaeanska» förkastade fraserna av en i förlinnaeanska arbeten vanlig typ; när Linné vid sin namngivning av arterna i Species plantarum anknöt till en sådan tidigare förekommande fras, gjorde han eljes regelbundet om den till ett adjektiv av typen *androsaemifolium* (så som han just gjorde i detta fall i andra upplagan av

Species, 1762). Han förvandlar med andra ord den adverbiella frasen till ett adjektivattribut.[1]

Några moderna artepitet av typen *foliis androsaemi* känner jag ej. Däremot finns det verkligen ett par exempel från sen tid på epitet av den andra typen, motsvarande *africana lutea*. Endast för några få år sen publicerades ett par dylika diatomacénamn, *Eunotia praerupta-nana* och *E. praerupta-minor* — lyckligtvis att betrakta som ej giltigt publicerade »nomina nuda». Ett namn av denna typ, som däremot allmänt synes accepteras som giltigt men som jag ej haft tillfälle att kontrollera på originalstället, är det av Blanchard 1904 lanserade *Betula coerulea grandis*, ett namn som verkar desto mera förbryllande som denne enligt litteraturen därjämte samtidigt skulle ha gjort en *Betula coerulea*, vilken enligt moderna auktorer skulle vara hybriden *B. coerulea-grandis* × *populifolia*.

Vilka typer av tvåordsepitet skola då kunna godtas som regelmässiga, alltså överensstämmande med binär linnaeansk metod? Först och främst måste de ju då principiellt ansluta sig till de vanliga ettordsepiteten i sitt förhållande till huvudordet-släktnamnet. Dessa »normala» epitet äro antingen substantiviska eller adjektiviska (i senare fallet ev. participformer av verb). De förra äro antingen nominativer eller genitiver, i förra fallet alltså appositioner till släktnamnet, i senare fallet genitivattribut. De adjektiviska epiteten äro adjektivattribut till släktnamnet och följa alltså detta till genus — detta bortsett från sådana fall, där adjektivet är substantiverat och alltså kan brukas i genitiv (som genitivattribut) enligt alternativ 1.

Granskar man de tvåordsepitet som gälla som giltigt publicerade enligt nomenklaturreglernas bestämmelser finner man också, att de mycket riktigt lätt låta sig ansluta i dessa formella hänseenden till

[1] Epitet av adverbiell typ, liknande de ovan från Gilibert hämtade, förekomma inströdda bland de dock starkt dominerande epiteten av normal linnaeansk typ i den lista i Linnés Pan suecicus (1749), där denne första gången mer konsekvent prövar den binära artnamnsprincipen. Säreget är, att Linné fäst så liten vikt vid denna sin utomordentliga uppfinning, att den enda kommentar han givit till dess införande i Philosophia botanica, där reglerna för bildningen av »nomina specifica», dvs. de beskrivande fraserna av förlinnaeansk typ, fylla många sidor är en kort, finstilt not: »Nomina trivialia forte admitti possunt modo, quo in Pane suecico usus sum» (enligt von Hofstens översättning i Sv. Linnésällsk. Årsskrift 18, 1935, p. 10: »*Nomina trivialia* kunna kanske införas på det sätt som jag har begagnat i Pan suecicus»); dessa *nomina trivialia* eller vad vi nu kalla artepitet skulle, enligt den så följande definitionen, bestå av ett enda ord (»Vocabulo unico»), närmare bestämt — för att citera Wikéns översättning — »ett ord taget fritt varifrån som helst» (»Vocabulo libero undequaquam desumto»).

ettordsepiteten, likaså att de lätt låta sig fördela ur formell-grammatikalisk synpunkt på några få grupper, m.l.m. parallella med ettordsepitetens. Det enda accepterade tvåordsepitet som helt faller utanför ramen är väl det säregna *noli-tangere*, som Linné använde för vår enda ursprungligt vilda *Impatiens*-art. Här är det att betrakta som ett sekundärt substantiv; det är nämligen (ehuru då i formen *Noli me tangere*) en förlinnaeansk benämning på växten i fråga, alltså av exakt samma typ som vårt svenska namn på *Myosotis:* Förgätmigej (och östgötskans i analogi med detta, egentligen för *M. palustris* gällande namn bildade förträffliga benämning på *M. arvensis:* Förgätmigbums). I de övriga fall, där *noli-tangere* använts, är det antingen upptaget i analogi med detta primära fall men utan tidigare anknytning till resp. växter eller avsett att utgöra genitivformen av *Impatiens*-epitetet, så som fallet är med ett par (väl identiska) *Septoria*-arter, som parasitera på *I. noli-tangere*; dessa båda ha likväl upptagits i min förteckning nedan, medan jag uteslutit de också existerande fall, där parasitsvampar fått det genitiviska epitetet *noli-tangeres*. I viss mån faller också ett annat epitet utom ramen: *non-scriptus*.

De övriga kunna fördelas på följande huvudgrupper efter epitetsordens förhållande till släktnamnet.

A. De båda orden bilda tillsammans ett genitivattribut till släktnamnet.

B. De båda orden bilda tillsammans en apposition till släktnamnet.

Den första typen av namn är synnerligen vanlig bland parasitsvamperna, där epitetet då vanligen utgör värdväxtens namn i genitiv, exv. *Puccinia cardaminis-bellidifoliae*, men inte sällan — i fråga om värdväxlande rostsvampar — är sammansatt av ett ord, hämtat från den ena värdens namn, och ett ord från den andras. Är då det första (som regel är) ett släktnamn, det andra däremot ett adjektiviskt artepitet, kan ju parasitsvampen få ett artepitet, som lömskt liknar ett epitet av förstnämnda slaget, alltså synes vara ett fullständigt artnamn, exv. *Melampsora allii-fragilis*, som ej är uppkallat efter en *Allium fragile* utan efter släktet *Allium* och *Salix fragilis*. Detta blir tydligare hos en annan, närbesläktad art med liknande värdväxling, vilken äger ett av de få epitet jag känner med tre ord, nämligen *Melampsora allii-salicis-albae*.

Det finns emellertid en hel mängd växter med tvåordsepitet av dylikt slag utanför parasitsvamparnas grupp, vilka uppkallats ej

efter någon växt utan efter en med dubbelnamn försedd fyndlokal eller oftast efter en person, vare sig denne förevigas i egenskap av mecenat eller finnare eller av annan anledning (en vanlig sådan är ju att vederbörande tidigare bestämt växten fel). Eftersom de förra ju i sin tur ofta äro uppkallade efter personer, kunna sådana geografiska epitet ibland ej skiljas från personnamns-dito, varför den i nomenklaturreglerna tidigare rekommenderade stavningen av de senare med stor initial, de förra med liten är ganska oförnuftig och i varje fall besvärlig, eftersom den kräver att man i varje enskilt fall tar reda på epitetsnamnets art; jag föredrar att (alldeles som vid ettordsepitet av samma slag) använda stor begynnelsebokstav i båda fallen. Som exempel må nämnas *Clermontia montis-Loa*, *Chenopodium Sanctae-Annae* (efter en ö), *Anthemis Sancti-Johannis* (efter Johannes Döparen själv, eller rättare sagt väl efter Johannes Döparens dag, med syftning på blomningstiden för arten — vilken f.ö. av vissa moderna auktorer dras in som varietet under en annan, tidigare beskriven, och kallas *A. gaudium-solis* var. *Sancti-Johannis*; ett sådant sammanfall av dubbelepitet i både art- och varietetsrang är i varje fall ytterst sällsynt). Ytterligare exempel, som samtidigt visa dels en korrekt, dels en mindre korrekt behandling av det ena epitetsordet, nämligen den förevigade personens förnamn: *Senecio Erici-Rosenii* (efter Eric von Rosen) och *Draba* × *Harry-Smithii* (som må nämnas som exempel på en binärt benämnd hybrid). Ej sällan är ena epitetsordet en titel, exv. i *Abies Borisii-regis*, *Euphorbia regis-Jubae*, *Sempervivum reginae-Amaliae*. Ett liknande namn är också *Rafflesia tuan-mudae*, vilket må nämnas såsom förrädiskt likt namnen med epitet av typ B på grund av att — som i fallet *Draba Harry-Smithii* — endast det ena av orden böjts; arten uppkallades av Beccari efter den dåvarande härskaren över Sarawak (den andre i denna säregna dynasti), Sir Charles Brooke, vars inhemska härskartitel var tuan Muda (tuan = herre). Jag skall f.ö. inte vidare uppehålla mig vid denna namngrupp, fast också den äger en del lustigheter, såsom *Abies equi-trojani* (som om den trojanska hästen skulle byggts av just detta träslag).

Jag skall i stället övergå till grupp B, som skulle utgöra mitt egentliga tema. Epiteten i denna grupp kunna i sin tur fördelas på två typer; i båda fallen är det ena ordet ett substantiv i nominativ, men det andra är i ena fallet ett genitivattribut till detta (alltså också ett substantiv, ev. ett substantiverat adjektiv), i andra fallet ett adjektivattribut eller ett substantiv av liknande ställning, alltså m.l.m.

tydligt brukat som apposition. Till den förra gruppen sluter sig det enda fall av treordsepitet jag känner utöver de förutnämnda svampnamnen, nämligen [*Papaver*] *corona-Sancti-Stephani*, likaså ett högst kuriöst epitet, vartill jag senare återkommer, där substantivet följs av ett dativattribut. Till typ 2 kan möjligen föras det en gång påträffade epitetet *anisum-olens*, vilket dock är lika tvetydigt som den svenska översättningen: doftande anis; rimligtvis måste man tolka epitetet som »anisdoftande», d.v.s. så att '*olens*' räknas som adjektivattribut, ej till *anisum* utan till släktnamnet (*Cookia*) med *anisum* som ackusativobjekt. Något analogt botaniskt epitet känner jag ej, men ett liknande zoologiskt fall erbjuder den på lindblad gallbildande gallmyggan *Dasyneura tiliamvolvens*, där de båda epitetsorden dock bruka sammanskrivas i ett.

Det har roat mig att under årens lopp försöka samla alla namn jag funnit med epitet av grupp B, men jag har inte gjort några som helst konsekventa inventeringar av namnindices för de olika växtgrupperna, varför det är mig alldeles obekant, hur stor procent av verkligen existerande sådana namn som jag träffat på. Eftersom det mig veterligt inte existerar någon sammanställning av dylika namn eller epitet och det å andra sidan, med tanke på lämpligheten eller olämpligheten av att även för framtiden tillåta dylika epitet, kanske kan ha en viss praktisk nytta att dock få någon hum om storleksordningen på denna grupp, så vågar jag mig på att publicera min lista, som den är — helst som jag funnit att även mycket erfarna systematiker tagit ganska mycket miste i fråga om antalet hithörande fall.

Vissa svårigheter möta vid avgränsningen av namnmaterialet. En svårighet ligger i att dylika epitet stundom sammanskrivas i ett ord eller — som man i en del fall kanske snarare bör säga — epitetet består av ett ord, som egentligen bildats genom sammandragning av två, vilkas ställning skulle motsvara den hos tvåordsepiteten av grupp B; ibland har då en bindevokal assimilerats, såsom i *virgaurea* (av *virga-aurea*), *spinalba* (av *spina-alba*). Ett och samma ordpar kan t.o.m. hos en författare slås ihop på detta sätt, hos en annan behandlas som två skilda ord. I sådana fall har jag strikt följt originalstavningen hos artens ursprunglige auktor, varför listan upptar exv. *Hieracium virga-aurea* men ej *Solidago virga-aurea*, eftersom den sistnämnda stavningen, som man stundom möter i litteraturen, ej är Linnés ursprungliga utan en senare, illegitim »uppsnyggning». Sammanskrivning utan assimilation föreligger i ett redan i klassiskt

latin existerande dubbelord som *cornucopiae*, vilket jag som epitet funnit endast i denna form och därför ej uppfört i min lista, medan jag där inbegripit *cornu-bovis* även i ett fall, där det faktiskt ursprungligen skrevs på oklassiskt sätt i ett ord. Likaså har jag i listan upptagit de båda fall, där jag funnit epitetet *pater-familias*, fast detta i ena fallet på originalstället skrevs i ett ord. Endast i ett fall har jag f.ö. avvikit från regeln och i listan upptagit ett vid originalpublikationen sammanskrivet epitet som tvåordigt, eftersom en hopskrivning här är grammatiskt orimlig; det gäller det rätt färska namnet *Aizoanthemum membrum-connectens* Dinter 1935, vars epitet också av senare författare skrivits i två ord.

Däremot har hopskrivning eller särskrivning iakttagits strikt efter originalkällan, när det gäller det ganska nyckfulla kapitel, som omfattar epitet hämtade från exotiska språk, till vilka jag strax skall återkomma. I överensstämmelse med nomenklaturreglerna har jag i listan (liksom i inledningens text) konsekvent förbundit epitetens båda ord med ett bindestreck, även när detta ej utsatts på originalstället, och i några linnaeanska fall omvandlat symbolerna ♀ och ▽ till resp. *Veneris* och *aquatica*.

En annan svårighet att avgränsa listans omfång är av nomenklatorisk-teknisk art. I litteraturen möter man ju utom giltigt publicerade och allmänt accepterade tvåordsepitet även ganska många, som visserligen fylla det förstnämnda villkoret (alltså äro ur teknisk synpunkt »validly published») men som ej längre användas, antingen därför att arten i fråga av systematiska skäl ej längre upprätthålles eller därför att namnet var illegitimt, d.v.s. regelstridigt, i allmänhet på grund av att det blott innebar ett onödigt utbyte av ett redan existerande giltigt epitet. Dessa kategorier ha båda upptagits i listan. Ur denna ha däremot uteslutits sådana namn, som visserligen setts i tryck men som aldrig blivit giltigt publicerade utan förblivit *nomina nuda*, oftast blott meddelade i synonymförteckningar. Eftersom de ha ett visst intresse har jag dock meddelat alla, jag funnit i tryck, i ett bihang till den egentliga förteckningen.

En sådan lista kan ju ge anledning till allehanda iakttagelser och reflexioner. Jag tänkte, att det möjligen kunde vara av något intresse att som avslutning på denna inledning meddela några av dem jag gjort.

Som redan sagt har jag inte annat än i vissa speciella fall gjort några efterforskningar för att komplettera min lista. Antalet funna fall av giltigt publicerade namn med tvåordsepitet av denna typ är likväl

ganska avsevärt, nämligen c. 280. Av dessa härstamma inte mindre än 72 från Species plantarum 1753 — men detta beror på att Linné i form av epitet räddat en mängd av den äldre skolans växtbenämningar (art- eller släktnamn) av denna konstruktion; gäller det ej alla — vilket är svårt att säkert fastställa — så gäller det de allra flesta. Eljes kan man ej påstå, att Linné visat någon faiblesse för epitet av denna typ — i hans senare verk har jag inte kunnat finna mer än 4. Från övrig 1700-talslitteratur äro c. 25 (varvid jag bortser från några svampnamn som bildats under denna tid men som blivit giltigt publicerade först genom att upptagas av Elias Fries). Stora flertalet härstammar från 1800-talet, men siffran 48 för 1900-talets nyskapelser visar, att seden långt ifrån dött ut — de fyra sista äro från åren 1951–1953.

Bland dessa nyaste är det av svensken Harling 1951 kreerade epitet, på vilket min rubrik syftar, Pyrrhas hår, nämligen i namnet *Carludovica coma-Pyrrhae*. De svenska författarna efter Linné ha på det hela taget varit mycket återhållsamma med tvåordsepitet; hos Elias Fries finnas dock 7 svampnamn med sådana, till synes bildade av honom själv, utöver några som han upptagit från äldre auktorer. För övrigt har jag mellan Linné och Harling funnit exempel endast hos Forskål (3), Linné fil. (2) och Sparrman (1) på 1700-talet samt hos algologerna Cleve (2) och Wittrock (1) i slutet av 1800-talet; därtill kommer ett nyligen publicerat av den svenskfödde, på Kanarieöarna verksamme Sventenius. Det kan i det sammanhanget kanske vara värt att nämna, att Thunberg uppenbarligen ogillade denna typ av epitet så livligt, att han rentav ändrade en del givna sådana: *Oxalis pes-caprae* döptes om till *O. caprina*, Sparrmans *Protea sceptrum-gustavianum* till *P. sceptrum*. På grund av Thunbergs auktoritet blevo dessa enligt våra regler ogiltiga nya namn länge allmänt använda.[1]

Vad beträffar utländska författare ha ju de flesta endast kreerat ett enda namn av listans typ, åtskilliga dock 2 eller 3; flera ha egentligen bara åstadkommits av Ehrenberg med 3 alger och 2

[1] De nämnda exemplen förekomma i Thunbergs dissertationer 1781 över resp. *Oxalis* och *Protea*. I Flora japonica (1784) finnas följande likartade fall: *Panicum corvi* (= *P. crus-corvi* L.), *Coix lacryma* (= *C. lacryma-Jobi* L.), *Thlaspi bursa* (= *T. bursa-pastoris* L.) och *Sisymbrium nasturtium* (= *S. nasturtium-aquaticum* L.), varjämte *Veronica anagallis-aquatica* L. citeras som *V. anagallis* L. Märkligt nog har en dylik omdöpning, ehuru ej helt konsekvent, skett även i dissertationen Flora strengnesensis (1791), vilken anses författad av respondenten, C. A. Carlson.

(dock aldrig giltigt publicerade) *Astragalus*-arter, SPEGAZZINI (6 namn av skilda grupper) och S. G. GMELIN (4 alger).

Granskar man dessa epitets fördelning på de olika växtgrupperna, så finner man att den är ytterst ojämn. Den överväldigande majoriteten, c. $^3/_4$ av alla, faller på fanerogamerna, därnäst komma svampar med 33 och alger med 23 (väl hälften desmidiacéer och diatomacéer) samt ormbunkar med 10; de återstående falla på lummerväxter, mossor, lavar och bakterier med 1 var. (Siffrorna hänföra sig genomgående till huvudlistan.)

Detta är nu ganska naturligt med hänsyn till dessa tvåordsepitets karaktär. Åtskilliga äro som nämnt m.l.m. äkta folknamn som tagits upp, och dessa torde väl — liksom fallet är med flertalet av de rena konstskapelserna — oftast innebära en jämförelse med ett dött föremål eller med något organ hos människa eller djur, fast jag tyvärr endast i få fall är kapabel att tyda dessa icke-klassiska epitet. De utgöra, dessa från alla världens hörn uppsamlade benämningar (där anmärkningsvärt nog LINNÉ synes stå för ett enda: [*Daphne*] *tarton-raira*), en ytterst brokig, exotiskt klingande skara, som synes av denna förteckning på dem jag funnit — till dels av helt färskt datum: *aracc-papa, caa-catú, core-core, ita-uba, kiska-loro, kok-saghyz, marajá-açu, marajá-y, nan-shan, niga-solu, pe-tsai, puchury-major, puchury-minor, quebracho-blanco, quebracho-colorado, sajor-caju, sinik-lagaraik, tarton-raira, tau-saghyz, ti-koua, tsjeriam-cottam, tuna-blanca, vira-vira.*

Samtliga dessa epitet höra till fanerogamerna med blott tre undantag: *Agaricus sajor-caju* FR., *Phyllachora sinik-lagaraik* SPEG. och *Placosphaeria caa-catú* SPEG.[1] I fråga om »liknelsenamnen» av klassiskt ursprung, så dominera dessa i alla makroskopiska grupper men äro också vanliga bland mikroskopiska växter, särskilt småalgerna. Gränsen för denna typkategori kan emellertid, speciellt i fråga om kryptogamerna, bli lite svår att dra, då liknelsen ibland hänför sig inte till själva växtens utseende utan till dess verkan, varvid epitetet m.l.m. nära ansluter sig till sådana särskilt bland fanerogamerna använda epitet, som syfta på en effekt av mer fysiognomisk art (eller i en del fall snarast på den psykologiska effekten på den mänsklige åskådaren). Det är ju bara rimligt att det enda tvåordsepitetet bland bakterierna är av nyssnämnda »effekt»-typ, näm-

[1] Det sistnämndas rätt till en plats i min lista är f.ö. diskutabel, då epitetet enligt SPEGAZZINI föranletts av att arten växer på blad av ett träd, som kallas caa-catú. Fallet är alltså jämförbart med de ovan diskuterade *noli-tangere*-namnen.

ligen *mors-prunorum*, givet åt en av de arter som åstadkomma gummiflöde hos stenfruktträd. Alldeles analog är ju krusbärsmjöldaggens benämning: [*Sphaerotheca*] *mors-uvae*. Flera svampepitet ge emellertid en beskrivning av den m.l.m. fördärvbringande parasiten eller effekten: *carbo-maydis* (»majs-kol»), *pestis-nigra* (och det enligt Spegazzini härmed liktydiga, underbara *sinik-lagaraik*), *rubigo-vera* — här är man redan nära ett sådant lustigt rent liknelsenamn som [*Sphaeria*] *pulvis-pyrius* (vilket helt enkelt är = krut) och det väl aldrig giltigt publicerade [*Agaricus*] *flos-sulphuris* (= svavelblomma). — »*Flos*», blomma, åtföljt av ett genitivattribut, bildar en ganska rikhaltig grupp av epitet, som i ett fall, nämligen *flos-aquae*, vattenblomma, är jämförbart med de sistnämnda »effekt»-typerna; det har använts för åtm. tre mikroskopiska alger, som genom sin massförekomst åstadkomma vattenblomning. En liknande effekt åsyftar väl det avvikande byggda epitetet *flos-marinus* för en diatomacé (*Polymyxus*). Å andra sidan finns också epitetet *flos-aëris* på en epifytisk orkidé; efter gök, häger och fågel i allmänhet ha andra »blom»-namn bildats. De övriga namnen med »*flos*» äro m.l.m. »tillägnelsenamn», såsom *flos-Idae*, *flos-Mariae*, *flos-Martini* och *flos-reginae*, av Retzius gjort som en artighet mot drottning Sofia Magdalena, på samma sätt som Sparrman ägnade Gustav III sin *Protea sceptrum-gustavianum*. Även ringare medlemmar i samhället ha dock ihågkommits, det finns också en »mulåsnedrivarens blomma» (*Pinguicula flos-mulionis* Morren).

Den vanligaste formen av »tillägnelsenamn» är ju den, där epitetet är ett personnamn i genitiv eller ev. ett av ett personnamn härlett adjektiv; exempel på den förra typen med tvåordsepitet lämnades i det inledande stycket. I detta sammanhang må emellertid nämnas den mera kuriösa form, där epitetet utgörs av ett namn i nominativ — en namnform som ju är allbekant från fjärilssystematiken, där stora delar av den grekiska guda- (och halvguda-)världen mobiliserats för att ge namn åt m.l.m. praktfulla dagfjärilsarter men också den nordiska mytologin lämnat bidrag; i dessa fall är epitetet naturligtvis egentligen bara ett uttryck för uppskattningen av fjärilens skönhet. Även i den botaniska nomenklaturen förekomma någon gång dylika namn ur mytologien eller den klassiska historien (ex. *Surirella Venus*, *Begonia Pyrrha* — väl efter samma hårsköna dam, som hugfästs genom Harlings *Carludovica*-namn). Det finns också exempel, om än sällsynt, på liknande namngivning efter levande personer, ungefär på samma sätt som familjen Poulsens damer

gett namn åt en rad av floribundarosor, exv. *Viola Helena* och *Lagenophora Helena*, liksom åtm. ett är mig bekant, där epitetet är ett geografiskt namn: *Cyanea Palakea*. Även några tvåordsepitet av detta slag ha hittats, det mest bekanta *Ida-Maia*, som amerikanen Wood gav en amaryllidacé (*Brevoortia*, numera förd till *Dichelostemma*), enligt vad som sägs för att ära sin dotter. Mer svårförståeligt är att taggiga kaktéer kallats *Santa-Rita* och *Santa-Maria*, liksom att epitetet *Sancta-Maria* fästs vid en *Chenopodium*, säkerligen dock i from avsikt, eftersom namngivaren var Velloso, som även är auktor till namnen *Pedicularis sceptrum-marianum* och *Cacalia cor-Jesu*.

Som exempel på den nyss antydda typen av tvåordsepitet, som häntyder på växtens behagliga uppenbarelse, må nämnas *decus-silvae* (skogens prydnad) och *decus-montium* (bergens prydnad), *splendor-sylvae* (skogens prakt) och *gloria-montis* (bergets ära) och väl även *gaudium-solis* (solens fröjd). Däremot får man väl uppfatta epitetet *gloria-Dei* snarare som ett liknelsenamn, alltså med betydelsen gloria = strålkrans, än som betydande »Guds ära».

Epitet med religiös anstrykning äro eljes ej sällsynta i denna grupp; liksom mytologiska personer ha också många av bibelns (mest gamla testamentets) ihågkommits, i synnerhet när det gäller epitet, som innebära jämförelser med något föremål attribuerat till dem eller med någon för dem karakteristisk kroppsdel — det senare har ju av diskretionsskäl knappast alls kommit i fråga, när det gäller historiska personer, ens i smickrande sammanhang. Som ett undantag får räknas det redan nämnda *coma-Pyrrhae*, givet åt en *Carludovica*-art med långa och grant brandgula staminodier efter en av Horatius besjungen skönt rödhårig dam. Men eljes visar listan (och dess appendix) både Medusas huvud, Junos hår och Venus' hår såväl som Venus' navle, Jupiters skägg jämte Moses' och Arons mindre bekanta dito och Judas' öra.

Även döda föremål tillhöriga bestämda personer förekomma rätt ofta som epitet; exempel äro Venus' spegel och Venus' kam, Neptunus' treudd och Hercules' klubba. Här finnas också Kristi törne och Andreas' kors, men med detta sistnämnda kan man ju sägas ha kommit över till en rent beskrivande term, på samma sätt som man också har malteserkorset använt (i form av *crux-melitensis* eller *crux-Maltae*). Samma sak gäller ju *calcar-equitis* (riddarsporre — använt på en riddarsporre-art, d.v.s. en *Delphinium*) och *bursa-pastoris* (herdeväska); i samma stil går ett lustigt kaktusnamn,

Cereus (numera *Pachycereus*) *pecten-aboriginum* (»infödingarnas kam»), medan en dess nära släkting, *Pachycereus* (ursprungligen *Cereus*) *columna-Trajani* på ett mera ovanligt sätt syftar på ett alldeles bestämt verkligen existerande exemplar av en sak: Trajanuskolonnen i Rom. Det enda analoga fall jag känner är den redan nämnda *Papaver corona-Sancti-Stephani* efter ungrarnas heliga stefanskrona — *sceptrum-carolinum* och *sceptrum-gustavianum* få ju tas mera symboliskt. Till infödingskammens kategori höra som än mera allmänna liknelser *crista-castrensis* och *ferrum-equinum* (hjälmbuske, resp. hästsko).

Eftersom djuren normalt skilja sig från människan genom att inte äga några lösa ägodelar, borde det heller inte finnas några dylika »besittningsnamn» attribuerade till djur. Satsen är kanske diskutabel, i varje fall tyder ett par artepitet därpå, dels det ena av dem som satts i rubriken: apans stege, *scala-simiae*, ett förträffligt epitet för den lianartade *Bauhinia*-art det gäller, och snäckans bädd, *lectus-cochleae*, givet åt en *Chrysoplenium*. Så finns det givetvis fågelbo, *nidus-avis*, dessutom ett mera specificerat sådant, nämligen hackspettsbo, *nidus-pici* (liksom också ett *nidus-puellae*, hur det nu lämpligen skall översättas).

Desto vanligare äro ju jämförelserna med olika kroppsdelar hos djur — och djur av mycket skilda slag. Vi ha exv. tigerns skägg (*barba-tigridis*), björnens ram (*branca-ursina*) och kattens klo (*unguis-cati*), kattens och kameleontens öga, hundens och lejonets tand, tuppens kam och kattens svans, huvud av björn, katt, oxe, tupp och skedstork, horn av oxe, get och hjortar, fötter av apa, tiger, get och fåglar; och från fågelvärlden dessutom häger-, korp-, tupp-, påfågels- och hackspettsben (samt en till släktet obestämd sporre), örnnäbb och svanhals. Och en hel[1] grizzlybjörn (*Ursus horribilis*) har behövts för att adekvat beteckna en ovanligt tagglurvig *Opuntia*.

På sätt och vis äro ju dessa epitet mera målande eller i varje fall mera fantasieggande än de som innebära en jämförelse med växter. De fall, där en jämförelse sker med en viss bestämd art genom att helt enkelt dennas hela artnamn upptas som epitet, äro mycket få. Jag känner blott ett enda: *Lycium prunus-spinosa*, eftersom man knappt hit kan räkna epitetet *brassica-florida*, som väl betyder blom-

[1] Eller snarare en trasig, att döma av auktors namnmotivering: »The old denuded stems and tufts and masses of matted long hairlike spines scattered around recalls the appearance of a desert tragedy in which a Mammalian namesake had given up the ghost, the elements gradually turning the remains back to dust.»

kål men som näppeligen blivit publicerat som botaniskt namn för denna. Men dessutom ha vi ett par fall, där ett tvåordsepitet, nämligen *uva-ursi*, använts så att säga sekundärt, bl. a. för en *Salix*, där epitetet, »björndruva», ju i och för sig är meningslöst; det skall heller inte tolkas så utan som »mjölon», d.v.s. *Arctostaphylos uva-ursi*, som *Salix*-arten liknar i blad och växtsätt men som i sin tur har sitt epitet (liksom sitt likabetydande släktnamn) på grund av sin frukt.

Det vanliga sättet för jämförelse med en annan växt är att epitetet består av ett släktnamn med tillägg av ett förtydligande adjektiv. Från modern tid äro sådana fall ytterst sällsynta, men ett må nämnas: *Primula* (senare *Omphalogramma*) *viola-grandis* av år 1914. Nästan alla äro eljes linnaeanska, minnen av en äldre, mindre exakt släktindelning. Här finnas sådana välkända namn som *Alisma plantago-aquatica*, *Veronica anagallis-aquatica* och *Sisymbrium* (senare *Rorippa*) *nasturtium-aquaticum*, *Opuntia ficus-indica*, *Hibiscus rosa-sinensis*, *Lysimachia* (sedermera *Asterolinon*) *linum-stellatum* och *Asplenium ruta-muraria*. För en trevlig trio algnamn av denna typ står den föga yngre S. G. Gmelin, nämligen de analogt bildade *Fucus abies-marina*, *F. erica-marina* och *F. rosa-marina* — alla nu förda till andra släkten.

Ett anmärkningsvärt linnaeanskt artpar, som närmast hör hit, är *Asplenium trichomanes-dentatum* och *A. trichomanes-ramosum*, anmärkningsvärt särskilt därför att Linné dessutom har en *Asplenium* med enbart *trichomanes* som epitet. Fallet synes mig särskilt värt att påpeka också som hjälp vid förståelsen av den hela serie av namn, som bland artnamn med tvåordsepitet intar en alldeles speciell ställning, nämligen de inte mindre än 8 arter, som Linné inom *Trifolium* gav epitet med ordet *melilotus*, efterföljt av ett adjektiv. Endast en av dessa, *T. melilotus-ornithopodioides*, räknas alltjämt (men ej enhälligt!) till *Trifolium*, medan tre föras till *Trigonella*; resten förs till det av Miller uppställda släktet *Melilotus*. Enligt nomenklaturreglernas grundprinciper rörande artnamnens prioritet, skulle ju i dessa fall arterna behålla sina epitet, *melilotus-coerulea*, *melilotus-officinalis* etc., även efter överföring till ett annat släkte än det ursprungliga, men eftersom »tautonym» (av typen *Larix larix*) ej äro tillåtna och ej heller, enligt en speciell paragraf, ett namn som *Nasturtium nasturtium-aquaticum*, så borde rimligen namn av typen *Melilotus melilotus-officinalis* också förbjudas. I själva verket ha alla forskare, som accepterat principen att förkasta tauto-

nym, negligerat sådana *Melilotus*-namn och i stället använt sådana som *Melilotus officinalis*, fast ingen bestämmelse införts härom i reglerna, trots förslag senast 1950. Möjligen kan detta bero på den uppfattning (som väl också ligger bakom sättet att vid ett namn som *Melilotus officinalis* citera LINNÉS auktorsnamn inom parentes, som om han kallat arten *Trifolium officinale*), att LINNÉ i själva verket inte menat dessa sammanställningar, *melilotus-coerulea* etc., som verkliga epitet utan (som T. A. SPRAGUE urgerat) att ordet *melilotus* skulle vara en inskjuten upplysning om artens tillhörighet till en viss grupp av släktet, liksom man enligt reglerna kan få, för upplysnings skull, skriva exv. *Astragalus* (*Cycloglottis*) *contortuplicatus*, där *Cycloglottis* är ett sektionsnamn, som ej ingår i den binära artnamnskombinationen. När nu LINNÉ, som nyss nämndes, i ett annat fall har två namn som *Asplenium trichomanes-dentatum* och *A. trichomanes-ramosum*, finns ingen anledning att tro, att han skulle skyggat för en liknande namngivningstyp inom *Trifolium*; och vore SPRAGUES tolkning riktig, är det ju obegripligt, varför LINNÉ skrev *Trifolium melilotus-coerulea* etc. med adjektivet i femininum, alltså anslutet till *melilotus* (som han behandlade som femininum) och ej till *Trifolium*. Det kan ju tilläggas, att några senare 1700-talsauktorer fogade ytterligare ett par dylika arter till *Trifolium*.[1]

Denna serie *Trifolium*-epitet är i stället det längst drivna exemplet på en företeelse som listan över tvåordsepitet ideligen visar upp: analogibildningen. Utom *Asplenium* finns det ännu några fall, där en och samma auktor samtidigt uppställt två arter med analogt bildade tvåordsepitet, så hos LINNÉ *Polypodium filix-mas* (nu *Dryopteris*) och *P. filix-femina* (nu *Athyrium*), FORSKÅLS båda *Dolichos*-arter *D. faba-indica* och *D. faba-nigrita* eller från senare tid (1861) SCHLECHTENDALS *Aspidosperma quebracho-blanco* och *A.* (nu *Schinopsis*) *quebracho-colorado*, för att ej tala om BARBOSA-RODRIGUEZ' besynnerliga palmnamn *Bactris marajá-açu* och *B. marajá-y*. Vanligare är att efter mönstret av ett dylikt namn ett liknande senare bildas i släktet, så som skett i *Strychnos* (*nux-vomica* L. 1753, *nux-blanda* A. W. HILL 1917), *Adiantum* (*capillus-Veneris* L. 1753, *capillus-Junonis* RUPR. 1867) och *Hedysarum* (*caput-galli* 1753, *cristagalli* MURR. 1774 — båda nu förda till *Onobrychis*). En synnerligen riklig serie finns, fastän delvis i form av *nomina nuda*, i *Panicum*

[1] Sedan ovanstående skrivits, har ett förslag ånyo framkommit att ogiltigförklara namnkombinationer som *Melilotus melilotus-officinalis*, denna gång framlagt av Mrs. M. L. SPRAGUE.

med följande (nu mestadels till andra släkten förda och delvis ej längre accepterade) arter: *P. crus-ardeae, crus-corvi, crus-galli* och *crus-pici*. En inte alldeles lyckad dylik analogibildning inom *Begonia* försöktes härom året av en kvinnlig amerikansk specialist, som åstundade — vilket i och för sig var högst lovvärt — att ge en korrekt binär sammelbeteckning för trädgårdarnas *semperflorens*-hybrider och därvid anslöt till Baileys tidigare förslag till binärt namn för de odlade hybriderna av *Begonia rex*. Bailey åstadkom det verkligt kvicka namnet *B. rex-cultorum*; Mrs. Krauss kreerade namnet *B. semperflorens-cultorum*.

En annan analogibildning är ännu mera påfallande och har redan mångfaldigt exemplifierats, den nämligen som består i att ett och samma epitet använts upprepade gånger, för arter i olika släkten men med inbördes likhet (eller i en del fall åtm. likhet med ett och samma jämförelseobjekt). Ehuru flertalet tvåordsepitet i min lista blott belagts med endast 1 fall var, finns det de som varit livligt använda. Populärast synes *crista-galli*, tuppkammen, vara, av vilket jag funnit 12 fall (1 troligen *nomen nudum*), syftande på något tuppkamsliknande än hos frukten (*Hedysarum, Calendula*), än hos blomställningen (*Rhinanthus, Erythrina, Cynosurus*) eller hos hela individet (diatomacén *Eunotia crista-galli*). Därnäst kommer *caput-Medusae* med 10 fall, fördelade på avskräckande lurviga uppenbarelser av så skilda slag som tickor, gräs, kaktus, lök och tistlar.

Det skulle, synes det mig, varit stor skada, om den binära principen för artnamn skulle tillämpats så strängt, att alla tvåordsepitet förbjudits. Inte ens för framtiden bör enligt mitt förmenande sådana förbjudas — men givetvis får man hoppas, att de förbli sällsynta och därmed behålla sin säregna charm. Man skulle väl också för framtiden kunna införa förbud mot epitet bildade av tre (eller flera) ord och för tvåordsepiteten införa vissa bestämmelser, som skilde legitima från illegitima. Tillåtna skulle då rimligen vara — jämte epiteten *non-scriptus* och *noli-tangere* — de, där de båda orden tillsammans bilda ett genitivattribut till släktnamnet, vidare de i min lista upptagna kategorier, där epitetet är en apposition till släktnamnet, bestående av ett substantiv jämte ett genitivattribut eller ett adjektivattribut (ev. ett som apposition stående substantiv). Även så kan man givetvis lika litet som när det gäller ettordsepitet undvika sådant nonsens som exv. det för en kinesisk *Cotoneaster*-art brukade epitetet *nan-shan*, vilket är precis lika klyftigt, som om man kallade en på Söder i Stockholm funnen ny maskrosart

»*Taraxacum soedra-bergen*». Ett fall skulle emellertid få förbli unikt, ett epitet som i sin fullkomliga brist på anknytning till växten är ett avskräckande exempel på botanisk namngivning, det må sen uttrycka något som vi alla längta efter: *pax-hominibus*, fred åt människorna.

I nedanstående lista över botaniska artnamn med tvåordsepitet av den typ, som definierats ovan (s. 526) under B, upptas alla av mig funna, som blivit giltigt publicerade (»validly published»), om också till en del illegitima i reglernas mening. Ett eller annat av namnen där, som jag ej kunnat kontrollera på originalstället, är dock möjligen ett »*nomen nudum*», d.v.s. ett namn publicerat utan beskrivning. Eljes ha dessa »nakna namn», i den mån de anträffats i litteraturen (vanligen som herbarienamn, meddelade i synonymlistor) uppförts i ett särskilt appendix. I båda listorna ha namnen ordnats efter epiteten, vilka uppställts i bokstavsföljd; under vart och ett har ställts det släktnamn (eller, om epitetet i fråga använts för flera olika arter, i alfabetisk ordning de släktnamn), varunder kombinationerna från början gjordes; släktnamnet åtföljs av ett auktorscitat med årtalet för publiceringen. Hela artnamnet fås alltså som i följande exempel:

caput-Medusae

Agaricus Fr. 1836–38[10]
Allium Airy-Shaw 1931,

vilket betyder, att epitetet *caput-Medusae* (bl.a.) använts i namnen *Agaricus caput-Medusae* Fr. 1836–38 och *Allium caput-Medusae* Airy-Shaw 1931. I det förstnämnda fallet anföres i not 10 i en till listan fogad notavdelning (s. 546) *Stropharia* Karst. 1879, vilket betyder, att arten numera räknas till släktet *Stropharia* och att denna överflyttning, resulterande i kombinationen *Stropharia caput-Medusae* (Fr.) Karst., gjordes av Karsten 1879. Så vitt det varit möjligt har på detta sätt resp. arters släkttillhörighet enligt modern uppfattning angivits, när denna är en annan än den ursprungliga. Saknas en sådan uppgift, betyder detta som regel, att den ursprungligen föreslagna systematiska anordningen alltjämt bibehålles, men i ett par fall (ex. *Dolichos faba-nigrita*, *Exidia auricula-canis*) beror avsaknaden av namn i notavdelningen på att artens systematiska ställning är mig alldeles oklar. I en del fall gäller dock osäkerheten inte själva släkttillhörigheten utan frågan om artens självständighet (eller identifiering), och då har släkttillhörigheten markerats med exv. (som i fallet *Trifolium melilotus-mauritanica*) ett *Melilotus* sp., varmed sagts, att arten i fråga hör till det nämnda släktet men att jag inte är i stånd att ange dess korrekta artnamn inom detta.

I några få fall, där arten sedan länge förts till det i noten nämnda släktet, har likväl, så vitt jag kunnat finna, den enligt reglerna giltiga namnkombinationen aldrig gjorts, d.v.s. listans epitet har ej lagts till grund utan vid överflyttningen ersatts med ett annat, illegitimt. Jag har i dessa fall nu bildat den korrekta namnkombinationen, exv. i fallet *Paranomus sceptrum-gustavianum*, som tidigare överförts till *Paranomus* men under namnet *P.*

sceptrum, vilket grundar sig på det regelvidriga namnet *Protea sceptrum*. I ett par andra fall (några *Agaricus*-arter) torde de riktiga namnkombinationerna finnas publicerade, men jag har ej kunnat avgöra var och har därför nöjt mig med att endast meddela namnet på det släkte, dit de nu räknas.

Givetvis har jag inte velat eller kunnat åtaga mig att för varje enskilt fall ange, om arten i fråga numera godtas som sådan — vilket dock är fallet med det alldeles övervägande flertalet växter i huvudlistan. Beträffande arter, som allmänt reducerats till former av tidigare beskrivna (eller anses helt identiska med sådana), anges detta i noten med att sistnämnda arts namn där angetts inom parentes och föregånget av ett likhetstecken, t.ex. *Taraxacum kok-saghyz* (= *T. bicorne* Dt 1906). I not har också angetts det korrekta namnet för resp. art i de fall, då listans namn blott varit vad som brukat kallas ett dödfött namn, d.v.s. ett namn som »på okynne» gjorts som ersättning för ett redan existerande regelriktigt namn; sådana okynnesnamn ha markerats med ett † framför epitetet. I några fall motsvara de ej fullständigt notens namn utan ha tvärtom föreslagits av vederbörande auktor som ny beteckning för en av honom genom sammanslagning av två äldre arter bildad kollektivart — t.ex. *Helleborus casta-diva*, en av N. Busch mot reglerna införd nybenämning av ett komplex, omfattande de tidigare beskrivna arterna *H. abchasicus* A. Br. och *A. Kochii* Schiffn., eller *Hoya corona-Ariadnes*, enligt Blume = *H. ariadna* Dcne + *H. speciosa* Dcne. Namnet i noten skall emellertid enligt reglerna gälla även för en sådan utvidgad art.

Förteckning över giltigt publicerade artnamn med tvåordsepitet av grupp B.

abies-marina
Fucus S. G. Gmel. 1768[1]

adiantum-nigrum
Asplenium L. 1753

aeschynome-sesban
† *Dolichos* Forsk. 1775[2]

agnus-castus
Arrabidaea DC. 1838
Vitex L. 1753

anagallis-aquatica
Veronica L. 1753 (*'Anagall. ▽'*)

anisum-olens
Cookia Blanco 1837[3]

aracc-papa
Solanum Juz. 1933

arbor-tristis
Nyctanthes L. 1753

assa-foetida
Ferula L. 1753

auricula-canis
Exidia Fr. 1822

auricula-Judae
Exidia [L. 1753 sub *Tremella;* ex] Fr. 1822[4]

barba-Jovis
Anthyllis L. 1753
Astragalus DC. 1802
Hydnum [With. 1796 et ex] Fr. 1821[5]

barba-tigridis
Prosopis F. Stuckert 1899

bella-donna
Amaryllis L. 1753
Atropa L. 1753

bella-villa
Carex Dewey 1866

bona-nox
Ipomoea L. 1762[6]
Smilax L. 1753

bonus-Henricus
Chenopodium L. 1753

branca-ursina
Heracleum All. 1785

brassica-florida
Lithothamnion Harv. ex Foslie 1905

brassica-offic[inarum?]
† *Raphanus* Cr. 1769[7]

bursa-pastoris
Thlaspi L. 1753[8]

caa-catú
Placosphaeria Speg. 1886

calamus-aromaticus
Andropogon Royle 1839

calcar-avis
Rhizosolenia Schultze 1858

calcar-equitis
Delphinium Standley 1937

capillus-Junonis
Adiantum Rupr. 1867

capillus-naidis
Ranunculus Arv.-Touv. 1871

capillus-Veneris
Adiantum L. 1753

caput-avis
Hosta Maek. ap. Nakai 1952

caput-bovis
Fedia Pomel 1874–76

caput-felis
Helianthemum Boiss. 1838

caput-galli
Hedysarum L. 1753[9]

caput-Medusae
Agaricus Fr. 1836–1838[10]
Allium Airy-Shaw 1931
Calligonum Schrenk 1841
Carludovica Hook. fil. 1890
Cirsium Schur 1866[11]
Elymus L. 1753[12]
Euphorbia L. 1753
Hydnum [Bull. ex] Fr. 1821
Mammillaria Otto 1837
Tillandsia Morren 1880

caput-plataleae
Rupicapnos Pomel 1871

caput-ursi
Hydnum Fr. 1863

carbo-maydis
Uredo Philippar 1837[13]

casta-diva
† *Helleborus* N. Busch 1903[14]

cauda-felis
Anthericum L. fil. 1781[15]

clava-Herculis
Zanthoxylum L. 1753

coeli-rosa
Agrostemma L. 1753[16]

collum-cygni
Aërangis Summerhayes 1927
Psittacanthus Eichl. ap. Mart. 1868

columna-Trajani
Cereus Karw. 1837[17]

coma-aurea
Chrysocoma L. 1753

coma-Pyrrhae
Carludovica Harling 1950

core-core
Geranium Steud. 1856

cor-Jesu
Cacalia Vell. 1827

cor-margaritae
Rhododiplobia Kirkpatr. 1912

cornu-bovis
Astragalus Lipsky 1901
Fomes Cooke 1884 (*'cornubovis'*)
Platanthera Nevski 1935

cornu-caprae
Meliola Hennings 1904[18]

cornu-cervi
Stylonema Reinsch 1875[19]
Polychilos Breda 1827[20]
Taphrina Giesenh. 1892

cornu-damae
Haloplegma Kütz. 1862
Rivularia Roth 1806[21]

corona-Ariadnes
† *Hoya* Blume 1848[22]

corona-imperialis
† *Fritillaria* Gaertn. 1788[23]

corona-Sancti-Stephani
Papaver Zapał. 1911

cortex-virens
Solanum Dunal ap. DC. 1852[24]

crinum-ursi
Festuca Ramond ex Schrad. 1806

crista-castrensis
Drepanocarpus Mart. ex Bth. 1838[25]
Hypnum L. 1753[26]

crista-galli
Calendula Viv. 1824
Corydalis Maxim. 1889
Cynosurus Munby 1847
Erythrina L. 1767
Eunotia Cleve 1891
Hedysarum Murr. 1774[9]
Lysimachia Pamp. ap. Hand.-Mazz. 1928
Menyanthes Menz. ex Hook. 1830[27]
Polygala Chodat 1913
Rhinanthus L. 1753
Veronica Stev. 1815

crus-ardeae
Panicum Willd. ex Nees 1829

crus-corvi
Panicum L. 1759
Carex Shuttlew. ex Kunze 1840–50

crus-galli
Crataegus L. 1753
Panicum L. 1753[28]

crus-pavonis
Oplismenus H. B. K. 1815[29]

crux-africana
Micrasterias Cohn 1876

crux-alternans
Staurastrum West 1897

crux-Andreae
Ascyrum L. 1753; L. 1763[30]

crux-Maltae
Abronia Kellogg 1863

crux-melitensis
Euastrum Ehrb. 1832[31]
Stauridium Corda 1835[32]

crux-Michaëli
Tetrapedia Reinsch 1867

decus-montium
Calceolaria Kränzl. 1916

decus-silvae
Dombeya K. Schum. ap. Engl. 1900
Kaempferia Hallier fil. 1896

dens-canis
Erythronium L. 1753

dens-leonis
Taraxacum Desf. 1798

erica-marina
Fucus S. G. Gmel. 1768

faba-indica
Dolichos Forsk. 1775

faba-nigrita
Dolichos Forsk. 1775

fel-terrae
Picria Lour. 1790[33]

ferrum-equinum
Ophrys Desf. 1807

ficus-indica
Cactus L. 1753[34]

filix-femina
Polypodium L. 1753[35]

filix-fragilis
† *Cystopteris* Borb. 1900[36]

filix-mas
Polypodium L. 1753[37]

flos-aëris
Epidendrum L. 1753[38]

flos-aquae
Byssus L. 1753[39]
Nostoc Lyngb. 1819[40]
Polocystis Wittr. 1879[41]

flos-ardeae
Adenocalymma Pittier 1917[42]

flos-avis
Aristolochia A. Chev. 1909[43]

flos-cuculi
Lychnis L. 1753

flos-Idae
Viola Hieron. 1881

flos-Jovis
Agrostemma L. 1753[44]

flos-Mariae
Viola Hieron. 1881

flos-marinus
Actinoptychus Brun 1891 (*'flos-marina'*)[45]

flos-Martini
Alstroemeria Ker-G. 1823[46]

flos-mulionis
Pinguicula Morren 1872

flos-reginae
Lagerstroemia Retz. 1789

foenum-graecum
Lysimachia Hance 1877
Trigonella L. 1753

gaudium-solis
Anthemis Velen. 1898

gloria-Dei
Helichrysum Chiov. 1935

gloria-montis
Lobelia Rock 1919

granum-paradisi
Amomum L. 1753 (*'gran. parad.'*)[47]

herba-alba
Artemisia Asso 1779

herba-barona
Thymus Lois. 1806–07

herba-venti
Phlomis L. 1753

Ida-Maia
Brevoortia Wood 1867[48]

ita-uba
Acrodiclidium Meisn. ap. DC. 1864[49]

kiska-loro
Opuntia Speg. 1905

kok-saghyz
Taraxacum Rodin 1933[50]

lacrima-virginis
Saracha Bitter 1922

lacryma-Jobi
Coix L. 1753

lectus-cochleae
Chrysosplenium Kitag. 1934

linum-stellatum
Lysimachia L. 1753[51]

marajá-açu
Bactris Barb. Rodr. 1875

marajá-y
Bactris Barb. Rodr. 1875[52]

medulla-panis
Polyporus [Pers. 1801 sub *Boletus;* ex] Fr. 1821

melilotus-coerulea
Trifolium L. 1753[53]

melilotus-corniculata
Trifolium L. 1753[54]

melilotus-cretica
Trifolium L. 1753[55]

melilotus-indica
Trifolium L. 1753[56]

melilotus-italica
Trifolium L. 1753[57]

melilotus-mauritanica
Trifolium Schousb. 1800[58]

melilotus-officinalis
Trifolium L. 1753[59]

melilotus-officinarum
Trifolium Cr. 1769[60]

melilotus-ornithopodioides
Trifolium L. 1753

melilotus-polonica
Trifolium L. 1753[61]

melilotus-segetalis
Trifolium Brot. 1804[62]

melilotus-sicula
Trifolium Turra 1765[63]

membrum-connectens
Aizoanthemum DINT. 1935 (*'membrumconnectens'*)

mons-Veneris
Polystictus JUNGH. 1838

mors-prunorum
Pseudomonas WORMALD 1931

morsus-ranae
Hydrocharis L. 1753

mors-uvae
Erysiphe SCHWEIN. 1834[64]

nan-shan
Cotoneaster MOTTET 1925

nasturtium-aquaticum
Sisymbrium L. 1753 (*'Nasturtium ▽: m'*)[65]

nidus-avis
Agaricus SECR. 1833[66]
Gymnosporangium THAXT. 1891
Ophrys L. 1753[67]

nidus-pici
Inonotus PILÁT 1942 (c. descr. gall.)

nidus-puellae
Karatas E. ANDRÉ 1888[68]

niga-solu
Areca BECC. 1914

noli-tangere
Agaricus FR. 1836–38[69]
Chrysothrix MONT. 1852
Impatiens L. 1753
Septoria GERARD 1873–74
Septoria THÜM. 1880

non-scriptus (-a, -um)
Grossularia A. BERGER 1924[70]
Hyacinthus L. 1753[71]

nux-blanda
Strychnos A. W. HILL 1917

nux-eben
Moringa DESF. 1829[72]

nux-vomica
Strychnos L. 1753

oculus-cati
Gnaphalium L. FIL. 1781[73]

oculus-chamaeleontis
Mastogonia EHRB. 1844

oculus-Christi
Inula L. 1753

oculus-Iridis
Coscinodiscus EHRB. 1839

oculus-solis
Tulipa ST. AMANS 1804

palma-pinus
Sagus GAERTN. 1788[74]

panax-siculum
Cachrys UCRIA 1796

pater-familias
Allium BOISS. 1859 (*'paterfamilias'*)
Ornithogalum GODR. 1854

pax-hominibus
Urostachys HERTER 1949

pecten-aboriginum
Cereus ENGELM. ex S. WATS. 1886[75]

pecten-Veneris
Cirrhopetalum GAGNEP. 1931
Scandix L. 1753 (*'pecten ♀'*)

penna-marina
Polypodium POIR. 1804[76]

pes-avis
Schefflera VIGUIER 1909

pes-avium
Trigonella BERTOL. 1850

pes-caprae
Agaricus FR. 1836–38[77]
Convolvulvus L. 1753[78]
Oxalis L. 1753
Polyporus PERS. ex FR. 1821

pes-simiae
Fomes BERK. 1856

pes-tigridis
Ipomoea L. 1753

pestis-nigra
Phyllachora SPEG. 1885
Placosphaeria SPEG. 1886

pe-tsai
Brassica BAILEY 1894[79]

pileum-turcicum
Agaricus Montagne 1856[80]

plantago-aquatica
Alisma L. 1753 (*'Plantago △'*)

prunus-spinosa
Lycium Dunal ap. DC. 1852

puchury-major
Nectandra Nees & Mart. ap. Nees 1836

puchury-minor
Nectandra Nees & Mart. ap. Nees 1836

pulvis-pyrius
Sphaeria Pers. ex Fr. 1821[81]

quebracho-blanco
Aspidosperma Schlecht. 1861

quebracho-colorado
Aspidosperma Schlecht. 1861[82]

rapum-genistae
Orobanche Thuill. 1799

rex-cultorum
Begonia Bailey 1923

rosa-malabarica
Hibiscus Ker-G. 1818[83]

rosa-marina
Fucus S. G. Gmel. 1768[84]

rosa-sinensis
Hibiscus L. 1753

rostrum-aquilae
Bicuspidella Pascher 1932

rosula-venti
Lobularia Svent. 1953 (?)

rubigo-vera
Puccinia [DC. 1815 sub *Uredo*] Wint. 1882

ruta-muraria
Asplenium L. 1753

sajor-caju
Agaricus Fr. 1821[85]

Sancta-Maria
Chenopodium Vell. 1827

Santa-Maria
Ferocactus Br. & R. 1922

Santa-Rita
Opuntia Rose 1908

scala-simiae
Bauhinia Sandw. 1931

sceptrum-carolinum
Pedicularis L. 1753

sceptrum-gustavianum
Protea Sparrm. 1777[86]

sceptrum-marianum
Pedicularis Vell. 1827

semperflorens-cultorum
Begonia H. Krauss 1947

sera-comans
Euphorbia Bub. 1841

sinapis-offic[inarum?]
† *Raphanus* Cr. 1769[89]

sinik-lagaraik
Phyllachora Speg. 1885

speculum-Veneris
Campanula L. 1753 (*'Speculum ♀'*)[87]

spica-venti
Agrostis L. 1753[88]

spina-alba
Bassovia Gris. 1877

spina-badia
Centaurea Bub. 1879

spina-Christi
Lycium Sennen & Elias 1930
Rhamnus L. 1753[90]

splendor-sylvae
Bignonia Mart. ex DC. 1845[91]

stella-aurea
Saxifraga Hook. fil. & Thoms. 1857

stella-nigra
Aldona Racib. 1900

systema-solare
Sphaeria Fuck. 1869[92]

tarton-raira
Daphne L. 1753

tau-saghyz
Scorzonera Lipsch. & Bosse 1913

ti-koua
Ficus Bur. 1888

tormentilla-erecta
† *Potentilla* Scop. 1772[93]

trichomanes-dentatum
Asplenium L. 1753

trichomanes-ramosum L.
Asplenium L. 1753

tridens-Neptuni
Staurastrum West 1897

tsjeriam-cottam
Ardisia R. & S. 1819[94]

tuber-regium
Agaricus Fr. 1821[95]

tuna-blanca
Opuntia Speg. 1925

umbilicus-Veneris
Cotyledon L. 1753 (*'umbilicus* ♀')

unguis-cati
Bignonia L. 1753
Mimosa L. 1753[96]

urna-viridis
Erica Bolus 1887

ursus-horribilis
Opuntia Alverson ap. Walton 1899[97]

uva-crispa
Ribes L. 1753

uva-ursi
Arbutus L. 1753[98]
Cotoneaster G. Don ap. Loud. 1830
Ligustrum Dcne 1879[99]
Salix Pursh 1814
Wikstroemia A. Gray 1865

viola-grandis
Primula Farrer 1914[100]

vira-vira
Gnaphalium Molina 1782

virga-aurea
Hieracium Coss. 1847

virga-pastoris
Scabiosa Mill. 1768

virga-sanguinea
† *Cornus* L. (Nathhorst) 1756 (*'virga sangv.'*)[101]

virga-tenuis
Andrachne Nevski 1937

vitis-idaea
Eugenia Raoul 1844[102]
Maytenus Gris. 1864
Vaccinium L. 1753

Appendix. Nomina nuda.

barba-Aronis
Astragalus Ehrb. ex Bge 1869

barba-Jobi
Hydnum Bull.

barba-Mosis
Astragalus Ehrb. ex Fisch. 1853

caput-serpentis
Asplenium Henriques ex Bak. 1891

crinum-ursi
Panicum Bory ex Steud. 1841

crista-galli
Panicum Grom. ex Trautv. 1884

crus-pici
Panicum Willd. ex Doell ap. Mart. 1877

filix-panna
Aspidium Lucanus ex C. Chr. 1906

flos-sulfuris
Agaricus Schnizl. ap. Sturm 1851

lingua-tucani
Eryngium Mart. 1823

ma-huang
Ephedra Liu 1927

Noter till föregående förteckning.

[1] *Cystoseira* Ag. 1821. — [2] *Sesbania sesban* (L. 1753) Merr. 1912. — [3] *Clausena* Merr. 1904. — [4] *Auricularia* Schroet. 1888. — [5] *Odontia* Fr. 1836–38. — [6] *Calonyction* Bojer 1837 (= *C. aculeatum* (L. 1753) House 1904). — [7] *Brassica oleracea* L. 1753. — [8] *Capsella* Med. 1792. — [9] *Onobrychis* Lam. 1778. — [10] *Stropharia* Karst. 1879. — [11] (= *C. spinosissimum* (L. 1753) Scop. 1772.) — [12] *Taeniatherum* Nevski 1934. — [13] (= *Ustilago maydis* (DC. 1815) Corda 1842.) — [14] *H. abchasicus* A. Br. 1853, s. ampl. — [15] *Bulbinella* Th. Dur. & Schinz 1895. — [16] *Silene* A. Br. 1843. — [17] *Pachycereus* Br. & R. 1908. — [18] *Irene* F. L. Stevens 1927. — [19] *Goniotrichum* Hauck 1885. — [20] *Phalaenopsis* Blume & Rchb. fil. 1860. — [21] *Chaetophora* Ag. 1824. — [22] *H. ariadna* Dcne 1844, s. ampl. — [23] *F. imperialis* L. 1753. — [24] (= *S. umbellatum* Mill. 1768.) — [25] *Machaerium* Ducke 1925. — [26] *Ptilium* De Not. 1869. — [27] *Fauria* Mak. 1904. — [28] *Echinochloa* R. & S. 1817. — [29] *Echinochloa* Schult. 1824. — [30] (1753 = *Hypericum mutilum* L. 1753; 1763 = *Ascyrum hypericoides* L. 1753.) — [31] *Micrasterias* Hass. 1845. — [32] *Micrasterias Cordae* A. Br. 1855. — [33] *Curanga* Merr. 1917. — [34] *Opuntia* Mill. 1768. — [35] *Athyrium* Roth 1799. — [36] *C. fragilis* (L. 1753) Bernh. 1806. — [37] *Dryopteris* Schott 1834. — [38] *Arachnis* Rchb. fil. 1886. — [39] *Aphanizomenon* Ralfs 1850. — [40] *Anabaena* Bréb. 1835. — [41] *Microcystis* Kirchn. 1900. — [42] *Stizophyllum* Sandw. 1937. — [43] *Pararistolochia* Hutch. & Dalz. 1927. — [44] *Polymyxus* De Toni 1894. — [45] *Lychnis* Desr. ap. Lam. 1789. — [46] (= *A. ligtu* L. 1762.) — [47] *Aframomum* K. Schum. 1903. — [48] *Dichelostemma* Greene 1894. — [49] *Endiandra* Bth. ex Bth. & Hook. 1880. — [50] (= *T. bicorne* Dt 1906.) — [51] *Asterolinon* Duby ap. DC. 1844. — [52] (= *B. floccosa* Spruce 1871.) — [53] *Trigonella* A. & G. 1898. — [54] ***Trigonella melilotus-corniculatus*** (L.) Hyl., n. comb. — *Trifolium melilotus-corniculata* L., Sp. pl. (1753), pl. 766 ('*Trifolium M. corniculata*'). — *Trigonella corniculata* L., Syst. ed. 10 (1759), p. 1180. — n. illeg. — [55] ***Trigonella melilotus-creticus*** (L.) Hyl., n. comb. — *Trifolium melilotus-cretica* L., Sp. pl. (1753), p. 765 ('*Trifolium M. cretica*'). — *Trigonella cretica* (Desf.) Boissier, Fl. Orient. II (1872), p. 91 — n. illeg. — *Melilotus cretica* Desfontaines, Fl. Atl. II (1798), p. 193. — *Pocockia cretica* (Desf.) Seringe in DC., Prodr. II (1825), p. 185 — n. illeg. — [58] *Melilotus indicus* All. 1785. — [57] *Melilotus italicus* Lam. 1778. — [58] *Melilotus* sp. — [59] *Melilotus officinalis* Lam. 1778. — [60] *Melilotus officinalis* Lam.; em. Thuill. — [61] *Melilotus polonicus* Desr. ap. Lam. 1796. — [62] *Melilotus segetalis* Ser. ap. DC. 1825. — [63] *Melilotus messanensis* (L.) All. 1785. — [64] *Sphaerotheca* Berk. 1876. — [65] *Rorippa* Hayek 1905. — [66] *Clitopilus*. — [67] *Neottia* L. C. Rich. 1818. — [68] *Bromelia* Mez ap. C. DC. 1896. — [69] *Psathyrella* Singer 1951. — [70] *Ribes* Standley 1930. — [71] *Scilla* Hg & Lk 1803. — [72] (= *M. oleifera* Lam. 1783.) — [73] *Eriosphaera* Less. 1832. — [74] *Raphia* J. Hutch. 1936. — [75] *Pachycereus* Br. & R. 1909. — [76] *Blechnum* Kuhn 1868. — [77] *Tricholoma*. — [78] *Ipomoea* Roth 1821. — [79] (= *B. pekinensis* (Lour. 1790) Rupr. 1860.) — [80] *Mycena*. — [81] *Melanomma* Fuck. 1869. — [82] *Schinopsis* Berkley & T. Meyer 1950. — [83] (= *H. hirtus* L. 1753.) — [84] *Constantinea* Postels & Rupr. 1840. — [85] *Pleurotus* Singer 1951. — [86] ***Paranomus sceptrum-gustavianum*** (Sparrm.) Hyl., n. comb. — *Protea sceptrum-gustavianum* Sparrman in Sv. Vet.-Akad. Handl. (1776), p. 300. — *Nivenia sceptrum-gustavianum* (Sparrm.) Druce in Second Suppl. to Bot. Soc. & Exchange Club Brit. Isles Report for 1916 (1917), p. 638. — *Protea sceptrum* Thunberg, Diss. Protea (1781), p. 21 — n. illeg. — *Paranomus sceptrum* [Thunb.] O. Kuntze, Rev. Gen. (1891), p. 580 — n.

illeg. — [87] *Legousia* Sch. & Th. 1907. — [88] *Apera* PB. 1812. — [89] *Brassica nigra* L. 1753. — [90] *Paliurus* Mill. 1768. — [91] (= *Memora flavida* (DC. 1845) Bur. & K. Schum. ap. Mart. 1897.) — [92] *Venturia* Wint. 1885. — [93] *P. erecta* (L. 1753) Räusch. 1797. — [94] *Embelia* A. DC. 1834. — [95] *Pleurotus* Singer 1951. — [96] *Pithecellobium* Mart. 1829. — [97] *O. erinacea* Engelm. 1856 var. *ursina* (Weber 1898) Parish. — [98] *Arctostaphylos* Spreng. 1825. — [99] (= *L. myrsinites* Dcne 1879.) — [100] *Omphalogramma* Farr. & Purd. ex Balf. 1915. — [101] *C. sanguinea* L. 1753. — [102] *Myrtus* Druce 1917.

Summary.

"Ape's ladder" and "Pyrrha's hair".

Reflexions on botanical species names with biverbal epithets, and a list of a special group of such names.

In the present International Code of Botanical Nomenclature (ICBN), Linnæus's Species plantarum (1753) is made the starting point of scientific botanical nomenclature. This work is the first one to use consistently the Linnæan method of binary names (binomials) for species, a method by which the name of a species is formed of the generic name followed by an "epithet" — instead of the descriptive phrase characteristic of pre-Linnæan specific names in cases where the generic name alone was not considered sufficient to designate the species, which often happened. Although the ICBN gives no definition of the binary method, nor of the epithet concept, the binary name system may roughly be described as a two-word system, the epithet being one single word; this is either a noun appended to the generic name as an apposition or genitive attribute, or is an adjective following, as an attribute, the generic name in gender. There are, however, exceptions to this rule, even in the Species plantarum, since this book contains not so few specific names with epithets of two words, not counting three cases where Linnæus, by mistake, gave an epithet of pre-Linnæan "phrase" type, *viz. Salvia afr*[*icana*]. *coerulea*, *Salvia afr*[*icana*]. *lutea*, and *Apocynum fol*[*iis*]. *androsaemi*, all of which were corrected in the second edition of Species plantarum in 1762. Phrases of the last-mentioned type, so common in pre-Linnæan works, were otherwise changed by Linnæus into adjectives, as in the case mentioned, where *fol. androsaemi* was replaced by *androsaemifolium*. On the other hand, such phrases were still retained to some extent, intermingled with typical Linnæan epithets, by Gilibert in his Flora Lithuanica (1781) and Exercitia phytologica (1791). These works should therefore be re-

jected as sources of specific names — as proposed by me in 1945 (Nomenklatorische und systematische Studien über nordische Gefässpflanzen, in Uppsala Universitets Årsskrift 1945) — since they belong, in my opinion, to the group of works covered by art. 79: 4 of the ICBN, which declares specific epithets illegitimate "when they were published in works in which the Linnæan system of binary nomenclature for species was not consistently employed".

Although nothing is stated in the ICBN on that point, epithets of two words may, nevertheless, in some cases be considered legitimate even for the future. Such legitimate biverbal epithets are, as can be concluded from praxis, mainly of two types, which are not defined in the Code, although the definition of the whole binary system depends on the circumscription of this somewhat erratic group of epithets. In the first type (type *A*), the two words of the epithet form together a genitive attribute of the generic name, although in some cases only one of the words is inflected, *e.g. Draba Harry-Smithii, Clermontia montis-Loa.* These names are especially common among parasitic fungi, e.g. *Puccinia cardamines-bellidifoliae, Melampsora allii-fragilis.* In some such cases also epithets of three words have been used, *e.g. Melampsora allii-salicis-albae.* It seems reasonable to suggest that this type of biverbal epithets — but not the triverbal ones — should be accepted also in the future.

In the second type (type *B*) of biverbal epithets, one of the words is a noun in the nominative, standing as an apposition to the generic name; the other in turn is a noun in genitive form or an adjective, but in both cases forming an attribute of the first word; in a few cases, the second word as well is a noun in the nominative, forming an apposition to the first word. One case is known, where the epithet consists of three words — *Papaver corona-Sancti-Stephani.* As for epithets of type *A*, it seems reasonable to allow biverbal — but not triverbal — epithets of type *B* also in the future, i.e., such epithets may not only be used when already existing, but new such epithets may also be formed. Also the erratic epithet *noli-tangere* should be allowed, but no other types of biverbal epithets, such as the hitherto unique type shown by the name *Urostachys pax-hominibus.*

For some years, the author has tried to list all validly published names with epithets of type *B*, and the result is now presented in the list above. This includes *c.* 280 cases, a rather remarkable number with regard to the fact that it has not been possible to search consistently in the various indexes, e.g. Index Kewensis, for such epithets.

To this list is appended another with some names of the same type found in literature merely as *nomina nuda*; some cases mentioned in the main list may also be *nomina nuda*, although it has not been possible to state this with certainty. The lists are arranged in alphabetical order according to the epithets; under each of these will be found the generic name used when the name was first published, together with its author and year of publication. When the same epithet has been used in more than one case, the various generic names are listed alphabetically in the same way. Remarks on the present taxonomic status of the species concerned are given in footnotes. Superfluous ("still-born") names are marked with a dagger

No less than 72 of the names in the main list are from the first edition of Species plantarum 1753. This high number is easily explained: most of these epithets were taken up by Linnæus from earlier literature, where they had been used as generic (or combined generico-specific) names. In later works of Linnæus, only 4 more cases could be found. Among hymenomycetes, where the starting point of nomenclature is 1 Jan. 1821 (Fries, Systema mycologicum), some earlier biverbal epithets were validated by Fries, who also made 7 seemingly new biverbal epithets of type *B*. There are but few other Swedish authors who have published such epithets, namely, Forskål, von Linné the younger, Sparrman, Cleve, Wittrock, Harling, and Sventenius, representing the period 1775—1953. One famous Swedish botanist, C. P. Thunberg, so strongly disliked biverbal epithets that he replaced quite a number of those already published by previous authors by univerbal epithets.

When considering the list as a whole from the temporal point of view, one finds, in addition to those of Linnæus, *c.* 25 cases published in the 18th century, 48 from the 20th century, the great majority thus belonging to the 19th century. As to the various systematic groups, the phanerogams dominate with about $^3/_4$ of all the cases, followed by the fungi with 33, algae with 23 (about half of which are desmids and diatoms), and ferns with 10 cases. Lycopods, mosses, lichens, and bacteria are represented merely by one case each.

In the Swedish text, examples are given of the various sources from where the epithets were taken — for the main part they are more or less metaphoric. A striking feature is the formation of analogous epithets within one and the same genus, as exemplified by such cases as *nux-vomica* and *nux-blanda* in *Strychnos*, *capillus-Veneris* and *capillus-Junonis* in *Asplenium*, etc. (see further p. 536).

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COBAEA AEQUATORIENSIS N. SP.

BY

ERIK ASPLUND.

During an excursion in July 1939 I found in the close neighbourhood of the town of Huigra on the Guayaquil—Quito railway in Ecuador a very conspicuous *Cobaea* with light green flowers hanging on long peduncles climbing in a thicket, and decumbent forming an entangled mass on the ground close to the thicket where the shrubs had obviously been cleared away. I collected some specimens and also put some anthers into acetic acid for my friend Prof. Erdtman, who had asked me to collect material for palynological research.

Prof. Erdtman found the pollen interesting and asked for the name of the plant. I was not able to identify it with any species described hitherto. In order to provide it with a name it seems thus necessary to describe it as a new species, the diagnosis of which follows.

Cobaea aequatoriensis Aspl. n. sp.

Suffrutex vel herba scandens. Caules sulcato-striati, subglabri sed sub nodos puberuli et villis paucis instructi. Folia generis, glabra; foliola 3-, interdum 4-juga, basalia et suprema opposita (vel subopposita), media saepissime alternantia, ad 10 cm longa et 3 cm lata, petiolulis brevissimis —5 mm longis instructa, basi obliqua, subcordata -rotundata, in petiolulum ± decurrentia, apice subacuta—obtusa, breviter mucronata; cirrhi ramosi.

Pedunculi in axillis solitarii, usque ad 40 cm longi, basi c. 3 mm diametro, apicem versus attenuati, praecipue in parte inferiore et juxta florem pilis crispis ad 3 mm longis villosi. Flores solitarii. Calyx fere ad basin quinquepartitus, lobis 2 (–2.5) cm longis, basi 5 mm, medio 4—4,5 mm latis, apice ± obliquis, acutis, extus marginibus versus et praecipue in margine ipso pilis eis pedunculorum similibus villosis, medio glabrescentibus usque glabris, intus marginibus versus ± pulverulenti-puberulis, ceterum glabris vel interdum tota superficie glabris. Corolla laete viridis; tubus parte infrastaminali leviter ventricosa, 7—8 mm longa, medio haud 1 cm lata,

extus intusque glabra, ad insertionem staminum paullum constrictus et intus annulo ciliato-villoso instructus, parte suprastaminali ampliata, extus sparse villosa, 6—7 mm longa. Corollae lobi 35 mm vel paullo ultra longi, glabri, basi 4,5—5 mm lati, sinuibus angustis vel angustissimis separati, laeves, c. 5 mm supra basin subabrupte vel aequaliter angustati, usque ad apicem lineares, vel interdum in parte superiore paullum ampliati, 2—3 mm lati, trinerves, undulati et inter nervos pustulis instructi, apice ± obliqui, plerumque paullum lacerati vel emarginati, saepe mucronulati. Stamina lobis corollae subaequilonga, 1 vel interdum 2 ceteris paullo breviora, filamenta basi densissime villoso-ciliata, ceterum glabra, antherae 10—12 mm longae. Discus quinquelobatus, lobis bifidis, 2—2,5 mm longis. Ovarium sub anthesin 6 mm longum, 3 mm latum, glabrum, Stylus 5 cm longus. Stigmata 10 mm longa, tota longitudine papillosa. Fructus (immaturus) ellipsoideus.

Hab. in Regni Aequatoriae provincia Tungurahua juxta oppidum Huigra, c. 1200 m s. m. 10 Jul. 1939 (Asplund 7739). Typus in Herb. Regnell.

In the Regnellian Herbarium there are two specimens of a *Cobaea* from the vicinity of Huigra (J. N. & George Rose 22273) provided with an unpublished herbarium name. One of them lacks corollas but is supplemented by photographs of complete flowers, the other one is accompanied by a detached flower. They seem to belong to the species described above though in the photographs the infrastaminal part of the corolla tube appears more strongly inflated and the suprastaminal one more abruptly widened than in my specimens. The detached flower is smaller than those of my plant, the calyx lobes being only 15 mm long, but otherwise it is similar.

Cobaea aequatoriensis differs from all other known species of the Section *Rosenbergia* by the long patent hairs of the peduncles. *C. Aschersoniana* Brand, placed by its author in a Section of its own, has also villous peduncles, but the corolla is widely different from that of *C. aequatoriensis* because of its long and wide tube and large wide basal part of its lobes. Some flowers of *C. aequatoriensis* have corolla lobes with a subabruptly narrowed basal part, but the difference between both parts is insignificant when compared to *C. Aschersoniana*.

Marginally villous calyx lobes occur in *C. gracilis* Oersted. However, in the type material in the University Herbarium of Copenhagen the villosity is conspicuous only in the flower buds, while in the open flowers most hairs have fallen off. Aside from the less conspicuous villosity of the calyx lobes *C. gracilis* differs from *C. aequatoriensis* by its glabrous peduncles and much wider sinuses between the corolla lobes.

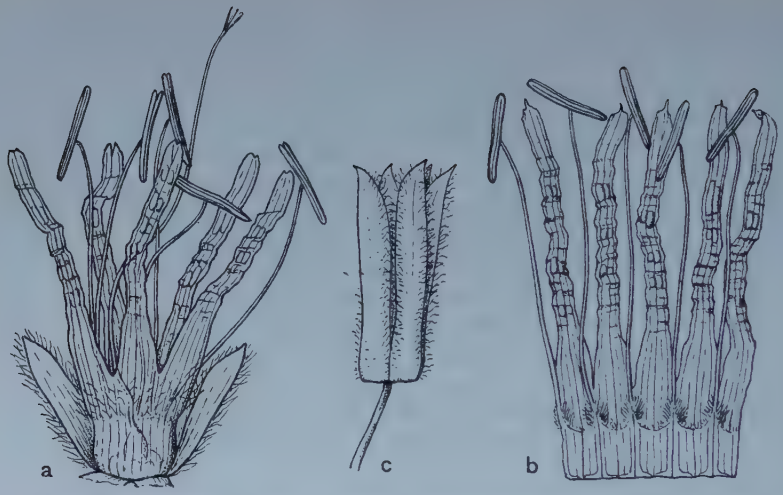

Fig. 1. *Cobaea aequatoriensis* Aspl., *a* flower, 2 calyx lobes removed to show the corolla tube, *b* corolla split up and seen from inside, *c* calyx with exceptionally asymmetrical lobes. All natural size. S. Ekblom delin.

Of the other species of Sect. *Rosenbergia* I have seen no authentic material. *C. panamensis* Standl. differs from *C. aequatoriensis* according to the original description and plate (Contr. U.S. Nat. Herb. 17 p. 452. Pl. 27) by glabrous calyx lobes and seemingly also peduncles, long attenuate calyx and corolla lobes and much longer stamens.

C. penduliflora (Karst.) Hook. f. and C. *Hookeriana* Standl. are two puzzling species. The first one was described and pictured by Karsten in his well-known "Florae Columbiae . . . specimina selecta . . ." (Berlin 1858), the type of the second one is Hooker's picture in Bot. Mag. (Tab. 5757). The first one was founded on specimens from Caracas, the second one on a specimen grown at Kew from seeds of the same locality. Pittier, who studied *Cobaeas* in nature in the vicinity of Caracas, united them under the older name (Bol. Soc. Venez. de Cienc. Nat. T. III (1935/36) p. 303—306), a reduction which is not possible without questioning the reliability of one or both of the pictures mentioned. He also gives an elaborate description drawn from living plants found by him near Caracas. *C. penduliflora* differs from *C. aequatoriensis* in having glabrous peduncles, only minutely pubescent calyx lobes and broad sinuses between the corolla lobes. Dr. Sandwith kindly informed me that a specimen of the Kew Herbarium collected by A. Ernst, who sup-

plied J. D. Hooker with the seeds from which the plant pictured in Bot. Mag. Tab. 5757 was grown, has glabrous peduncles, a fact which is not clearly stated in available descriptions. A herbarium specimen of the plant cultivated at Kew does not seem to exist.

C. Lasseri Pittier seems to be an *Eu-Cobaea* rather than a *Rosenbergia* judging from the description ("calycis segmentis . . . apice rotundatis extus glabris, corolla glaberrima . . . lobulis brevibus latis apice rotundatis"), although it is compared with *C. penduliflora* by its author. As is evident from the part cited of the description it differs very much from *C. aequatoriensis.*

Undulate corolla lobes seem to be a common feature to all species of Sect. *Rosenbergia,* but the pustules in the areas between the nerves seem to be peculiar to *C. aequatoriensis,* at least as far as can be judged from herbarium specimens. However, herbarium material of the plants in question is mostly unsatisfactory, since the delicate corolla lobes have mostly been more or less withered before the specimens have been put in press. The pustules are as wide as the distance between the nerves and they may be opposite or more or less regularly alternating.

The tips of the corolla lobes are rather variable. Generally they are somewhat asymmetrically erose or emarginate and apiculate from the excurrent midnerve, occasionally also from one of the lateral ones. In one lobe I found the middle nerve bifid a little below the apex and both branches forming apicules.

The calyx lobes are usually but slightly oblique at the apex, but occasionally they are very asymmetrical. In such lobes the villosity may be almost missing on one side of the lobe (Fig. 1 *c*, left sepal).

The normal habit of *C. aequatoriensis* seems to be that of a suffrutex with herbaceous climbing branches. The creeping herbaceous stems with decumbent entangled branches most probably came from roots of plants which had been cut down when the thicket in which they climbed was cleared away.

The pollen of *C. aequatoriensis* was described by Prof. Erdtman in his large work "Pollen Morphology and Plant Taxonomy" (Stockholm 1952) p. 330. He has kindly contributed the following more detailed description:

"Acetolyzed pollen grains spherical (diameter about 150 μ), polyforate. Exine about 15 μ thick (sexine 12 μ, nexine 3 μ).

Sexine reticulate. Diameter of lumina about 20 μ. Muri straight or usually slightly curved, about 12 μ high and 2.2 μ wide, provided

with microbacula (about 7 μ long and 0.5 μ wide). Diameter of foramina about 8 μ. Mean distance between centres of adjacent foramina about 33 μ. Foraminiferous lumina surrounded by 5 or 6 nonforaminiferous. Ectosexinous part of muri about 4 μ thick, consisting of an upper, bright, very homogeneous layer (thickness about 2.5 μ) and an inner, slightly greyish layer (thickness about 1.5 μ) merging into the endosexinous, baculate part of the muri. Each lumen surrounded by 20—24 bacula.

Nexine provided with a distinct endonexinous layer."

Prof. ERDTMAN also states that the pollen of *C. panamensis* reminds of that of *C. aequatoriensis*, but the grains are larger (diam. *c.* 188 μ).

I am much indebted to Dr. CH. BAEHNI of Geneva and Dr. O. HAGERUP of Copenhagen for the loan of herbarium specimens, to Dr. SANDWITH of Kew for a copy of the description of *Cobaea Lasseri* and for the information about *Cobaea* specimens of the Kew Herbarium, to Dr. MELDERIS of British Museum (Natural History) for a copy of PITTIER's paper on *Cobaea penduliflora*, and to Prof. ERDTMAN for the pollen description.

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TRANSPORT OF LABELLED PHOSPHORUS TO PINE SEEDLINGS THROUGH THE MYCELIUM OF CORTINARIUS GLAUCOPUS (SCHAEFF. EX FR.) FR.

BY

ELIAS MELIN and HARALD NILSSON.

In a previous paper from this institute (Melin and Nilsson 1950) it was shown, by using the isotope technique, that the mycelia of *Boletus variegatus* (Sw.) Fr. in mycorrhizal connection with pine seedlings are able to transfer labelled phosphorus from a phosphate solution to the roots of the higher partner. From there the isotope is rapidly distributed throughout the plant. In the experiments referred to, aseptic pine seedlings were grown on sand in Erlenmeyer flasks and inoculated with *B. variegatus*. When mycorrhizae had become well developed, the isotope P^{32} was added. By special arrangement only mycelia were exposed to the isotope and then the radioactivity was measured in different parts of the seedlings. It should be emphasized that the roots as well as the mycorrhizal mycelia were quite intact during the experiment. In subsequent experiments it was demonstrated that the hyphae of *B. variegatus* are capable of transferring nitrogen to the roots (Melin and Nilsson 1952, 1953), and in recent experiments (Melin and Nilsson, unpublished) they were also found to transport cations to the seedlings).

In the experiments reported below, another pine mycorrhizal fungus, *Cortinarius glaucopus* (Schaeff. ex Fr.) Fr., has been studied concerning its capacity of transferring phosphorus to pine seedlings. This fungus differs physiologically from *Boletus variegatus* in several respects (Melin, unpublished), and it seems to be much more dependent on the roots than the latter (Melin 1954).

C. glaucopus, in experiments recently carried out in this laboratory (Nilsson, unpublished), proved to be a mycorrhiza-former with

Table I. Measured activities and volumes of seedling portions indicated in Fig. 1.

Part of seedling (cf. Fig. 1)	Imp./min.			Volume, ml		
	a	b	c	a	b	c
I	5.2	27.8	—	0.03	0.04	—
II	40.6	—	—	0.03	—	—
III	49.3	50.0	—	0.02	0.03	—
IV	38.4	43.7	48.8	0.02	0.02	0.03
V	36.5	29 2	—	0.03	0.04	—
S	44.0	30.2	21.9	0.06	0.07	0.06
N	25.9	18.4	—	0.15	0.15	—

The activity of the sand was 12.4 imp./min./0.1 ml.

pine (*Pinus silvestris*). The bluish mycorrhizae formed in pure culture (Melin 1936) were dichotomously branched; contrary to the mycorrhizae produced by *B. variegatus*, however, they had a fairly smooth surface without radiating hyphal strands.

The experimental method used was that previously described (Melin and Nilsson 1950). In wide-necked 500-ml Erlenmeyer flasks glass cups were placed near the wall. Both vessels were supplied with purified sand to which was added a nutrient solution (Melin and Nilsson l.c., p. 89). Early in the spring one aseptic seedling of *Pinus silvestris* was introduced into each of the Erlenmeyer flasks and after 3—4 months mycelia of *C. glaucopus* were brought into the cups. Their hyphae grew easily over the edges of the cups into the sand of the Erlenmeyer flasks. After six weeks (in September) mycorrhizal relations had become fairly well established. Radioactive phosphorus as H_3PO_4[1] was then added to the cups in quantities varying from 10 μc to 1 mc in the individual experiments. After two days of exposure the activities of the seedlings were determined. The portions of roots, stems and needles to be measured on their activities were wet-ashed in sulphuric acid and perchloric acid and then measured directly in liquid sample Geiger-Müller tubes.

The experimental results are illustrated in Table I, which gives values of measured activities and volumes of portions indicated in Fig. 1. The mycelium of the cup had in this case been exposed for

[1] Obtained from Isotope Division, Ministry of Supply, Harwell, Didcot, Berks.

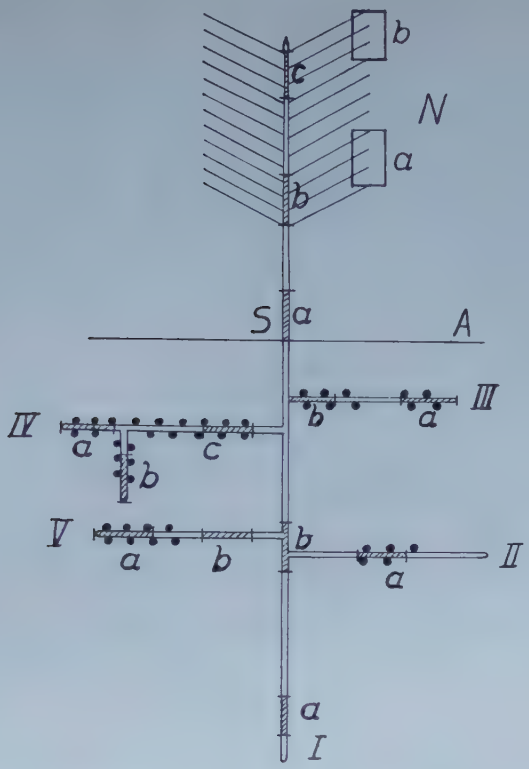

Fig. 1. Schematic drawing of pine seedling used for radioactive measurements given in Table I. A = Sand level; S = Stem; N = Needles; I = Main root; II—V = Lateral roots (black dots indicate well-developed mycorrhizae); a—c = Portions measured for radioactivity. (Cf. Tables I—II.)

Table II. Activities and corresponding amounts of P^{32} calculated for 0.1 ml as unit volume.

Part of seedling (cf. Fig. 1)	Imp./min./0.1 ml			P^{32}/0.1 ml × 10^4 mγ		
	a	b	c	a	b	c
I	17.3	69.5	—	9.8	39.5	—
II	135.3	—	—	76.9	—	—
III	246.5	166.7	—	140.0	94.7	—
IV	192.0	218.5	162.7	109.0	124.1	92.4
V	121.7	73.0	—	69.1	41.5	—
S	73.3	43.1	36.5	41.6	24.5	20.7
N	18.5	12.3	—	10.5	7.0	—

two days to 0.1 mc P^{32}. In Table II the figures are calculated for 0.1 ml as unit volume.

The results agree fairly well with those obtained in the experiments with *Boletus variegatus*. Root portions with mycorrhizae contained considerable amounts of P^{32}. It would therefore seem evident that the isotope had been transported by the mycelia from the cups to the mycorrhizal roots. Older non-mycorrhizal portions of lateral roots, such as *Vb* (Fig. 1), also showed relatively high activities. This indicates that the isotope had also been transferred from the fungal associate to the root cells. From there it had been translocated to the aerial parts of the seedlings.

It may be concluded that also under natural conditions *Cortinarius glaucopus* is capable of transporting phosphorus to its higher symbiont. It seems reasonable to believe that mycorrhizal fungi of trees in general have the same ability.

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Institute of Physiological Botany, University of Uppsala, April 1954.

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THE RESPONSE OF SOME HYMENOMYCETES TO CONSTITUENTS OF NUCLEIC ACIDS.

BY

NILS FRIES.

Introduction.

A growth-promoting effect of adenine and related compounds upon higher fungi has been noticed in several instances during the last few years (Fries 1950, 1951, Yusef 1953). These observations were based on comparatively few experiments, and no other variables except the purine factor were studied. The present paper describes the response of some Hymenomycetes to purines under varied experimental conditions, e.g. with different carbon and nitrogen sources, at different incubation temperatures, and with incubation periods of varying length. The influence of adenine on growth was apparent under all conditions tested; the experiments led to the unexpected result, however, that some species respond to adenine by an abbreviated lag phase, others by an increased total production of living matter.

The author is indebted to Mrs. Brita Nyman, Fil. kand., and Mrs. Harriette Cedervall, for valuable technical assistance. The investigation was supported by grants from Eli Lilly and Co., Indianapolis, and "Harald och Greta Jeanssons Stiftelse", Stockholm.

Material and Method.

The species studied are listed in Table I. They were isolated as polysporous cultures from single fruit-bodies, except *Polyporus abietinus*, which was derived from a crossing between two compatible haploid strains, and *Lentinus lepideus*, which was an old laboratory strain of untraceable origin. *Mycena flavo-alba* (strain No. 315) was used as the chief test object, since this species was earlier found to respond very strongly to adenine. Two species,

Table I. A list of the strains studied.

U = fruit-bodies collected in the neighbourhood of Uppsala; pure polysporous or tissue culture isolated by the author.

Species	Strain No.	Year of isolation	Origin
Mycena flavo-alba (Fr.) . . .	229	1948	U
Do.	315	1948	U
Do.	354	1951	U
Do.	355	1951	U
Do.	356	1951	U
Do. (a "gigas" form)	361	1951	U
Do.	365	1951	U
Do.	368	1951	U
Do. (fruit-bodies atypical) . .	373	1951	U
Mycena rubromarginata (Fr.)	–	1948	U
Lentinus lepideus (Fr.) . . .	–	?	Stock culture collection of Prof. E. Melin's laboratory
Polyporus abietinus (Dicks.) Fr.	–	1934	U (a dikaryotic mycelium)
Polyporus annosus Fr. . . .	–	1944	U
Peniophora fraxinea . . . . (Pers.) Lll.	–	1949	Collected *c.* 40 km N of Uppsala by J. Eriksson, Fil. lic.

notably *Lentinus lepideus*, and *Peniophora fraxinea*, were studied, although their rate of growth was not affected by added purines; the reason for including them in the investigation will appear later from the context.

As stock cultures all the strains were usually kept on malt-agar (2.5 per cent malt extract and 1.5 per cent agar). The culture flasks of the experiments were inoculated from mycelia growing on malt-agar plates. Particulars of the inoculation method and certain other technical details are given in Fries (1949). Unless otherwise stated the following composition of the basal liquid medium, M 3, was used: glucose 20 g, ammonium tartrate 5 g, KH_2PO_4 1 g, $MgSO_4 \cdot 7\ H_2O$ 0.5 g, NaCl 0.1 g, $CaCl_2$ 0.1 g, $ZnSO_4 \cdot 7\ H_2O$ 4.43 mg, $MnSO_4 \cdot 4\ H_2O$ 4.05 mg, $FeCl_3 \cdot 6\ H_2O$ 4 mg, thiamin 40 µg, and distilled water 1 liter. Each 100 ml Erlenmayer culture flask contained 25 ml of this solution with or without further additions. After inoculation, the flasks were incubated at +25° C. Each experimental series comprised 5 or 6 identical cultures. The time of incubation varied with the species.

The amount of glucose present in the substrate of the growing fungus was determined according to Somogyi (1945).

Table II. The effect of different amounts of adenine on the growth of *Mycena flavo-alba*, No. 315 (two experiments, I and II), and *Mycena rubromarginata*.

Time of incubation 25 days.

Adenine added, mg per flask	Dry weight of mycelium per flask, in mg		
	Mycena flavo-alba		*Mycena rubromarginata*
	I	II	
0	2.3±0.2	2.9±0.2	1.8±0.3
0.001	–	3.2±0.3	–
0.003	–	3.4±0.2	–
0.01	4.3±0.3	3.8±0.2	3.6±0.5
0.03	–	4.9±0.3	–
0.1	8.0±0.3	9.5±0.7	5.3±0.7
0.3	–	8.2±0.6	–
1	8.9±0.6	8.5±0.5	6.2±0.4
3	–	0.9±0	–
10	0.4±0.1	0.4±0	1.7±0.4

Experiments.

A. Fungi whose initial growth is promoted by adenine.

From earlier experiments (Fries 1950, 1951) it was concluded that adenine caused an increased initial rate of growth at least in the following seven species: *Polyporus abietinus, P. annosus, Mycena flavo-alba, M. rubromarginata, M. metata, M. zephira,* and *Lenzites betulina*. The four first-named species, which responded most strongly to adenine, were more closely studied.

First, the activity of adenine was tested under varying cultural conditions, in order to find out whether the effect was bound up with a particular environmental factor. In these experiments adenine was supplemented in amounts of 300 μg (= 2.24 micromoles) or 1,000 μg (= 7.46 micromoles) per flask, since earlier tests had shown these concentrations to be within the range of maximal activity.

In all cases tested, adenine produced its maximal effect in a concentration of about 4 to 40 mg (= *c.* 30 to 300 micromoles) per liter. The lowest concentration showing any activity was about 0.4 mg (= 3 micromoles) per liter (Table II). Adenine could be replaced by adenosine, which in *Polyporus abietinus* and *P. annosus* displayed an

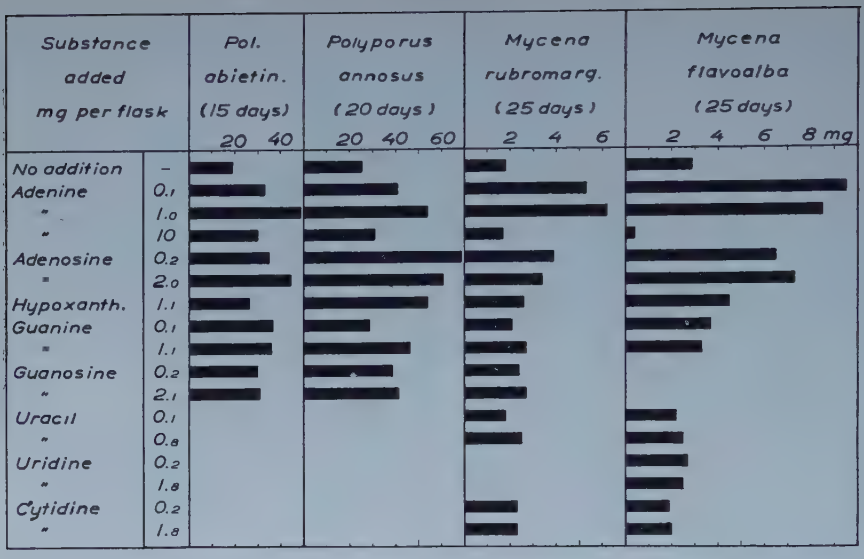

Fig. 1. The effect of adenine and related compounds upon the growth of four species of Hymenomycetes.

equal, in the *Mycena* species a somewhat lower activity (Fig. 1). Hypoxanthine, guanine and guanosine, on the other hand, could be used with almost the same efficiency as adenine by *Polyporus abietinus* and *P. annosus*, but seemed to be inferior or without activity in the *Mycena* species.

Since the activity of purines had earlier been studied exclusively in cultures with liquid nutrient solutions, it seemed worth while to repeat an experiment with *Mycena flavo-alba* using a semi-solid agar medium in Petri dishes with and without adenine. On such a substrate the growth rate in terms of radial increment (hyphal growth in mm/day) as well as the finally attained dry weight can be measured. An advantage with an agar substrate is that only one mycelium arises from each inoculum, and no secondary mycelia, as in flask cultures, can cause any complications (cf. Lilly & Barnett 1951, p. 29). On the other hand, the determination of the dry weight must be performed after heating the agar to 100° C, the mycelium thus being killed before its removal from the plate, and the dry weight values cannot, therefore, be directly compared with those obtained from flask cultures. In this experiment, the results of which is summarized in Fig. 2, the variability within the species of *Mycena flavo-alba* was studied also, by using inoculation material from nine dif-

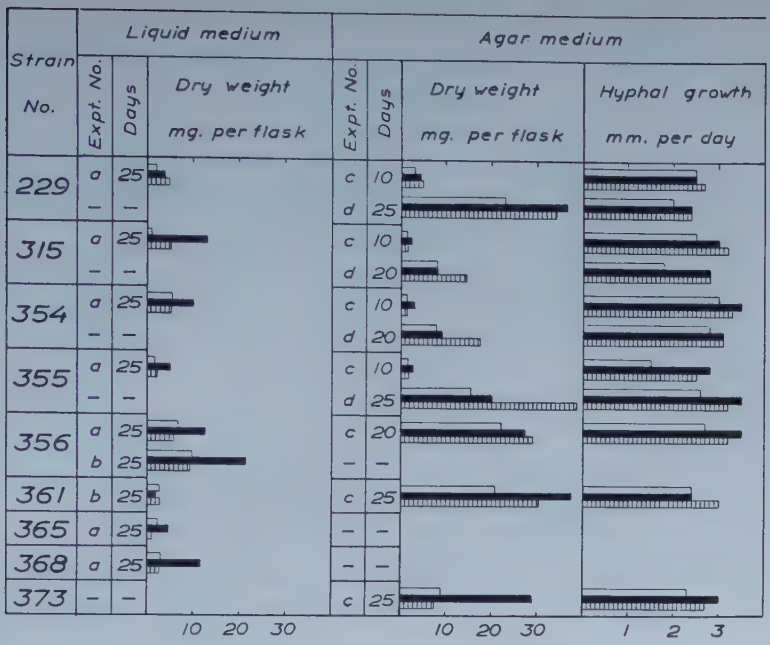

Fig. 2. The influence of adenine and tyrosine on dry matter production and hyphal growth rate in nine strains of *Mycena flavo-alba*. White columns: controls; black columns: adenine added (1 mg per flask, 0.2 mg per plate); hatched columns: tyrosine added (1 mg per flask, 0.2 mg per plate).

ferent strains. Furthermore, the response to tyrosine was tested, since this amino-acid has been found to promote growth of a strain of *Mycena flavo-alba* (Fries 1949).

Each strain proved to respond positively to adenine, at least in some series, and most of them also responded to tyrosine. The growth rate in general as well as the strength of the response, however, varied very much from one strain to another. No correlation could be found between the size of the mycelium and its dry weight in the agar plate series. In one case (No. 361 c) adenine caused a doubling of the dry weight but did not affect the rate of hyphal growth, in another case (No. 315 d) the situation was almost the reverse. The mode of growth was also rather different in the different strains: more dense and compact in some, thinner and looser in others. However, as a result of the experiment it can be concluded that the positive response to adenine is a physiological character of the species *Mycena flavo-alba*, although the reaction in certain strains occasionally may fail to appear. The same can be said with regard to

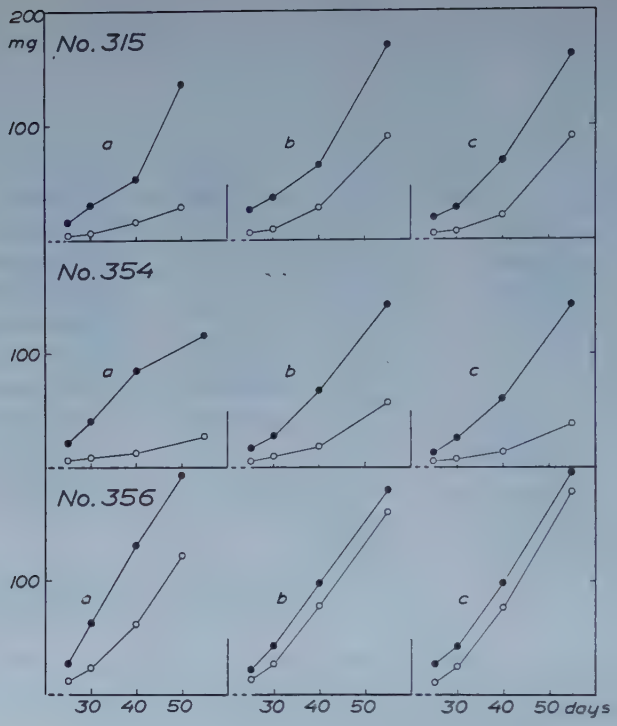

Fig. 3. The response to adenine in three strains, Nos. 315, 354, and 356, of *Mycena flavo-alba* grown in liquid culture. Open circles: without adenine; filled circles: with 300 μg adenine per flask. The age of the inocula was: (*a*) 10, (*b*) 15, and (*c*) 20 days.

tyrosine, the generalization in this case, however, being less firmly established. On the whole, the increment in dry weight was more rapid on the agar plates than in the liquid cultures, and especially the response to tyrosine was more pronounced in the former than in the latter series.

The rather different results obtained in repeated experiments with the same strains led to the suspicion that the origin of these differences was to be found in the inoculation material, the age of which varied from one experiment to another. This possibility was examined in an experiment where the inocula were taken from malt-agar plate cultures, 10, 15, and 20 days old, respectively. Three strains of *Mycena flavo-alba* were used, viz. Nos. 315, 354, and 356. The growth rate and response to adenine were recorded as time curves, finished after 50 or 55 days (Fig. 3). The mycelia developed from the youngest inocula appeared to be most sensitive to adenine

Table III. The influence of the presence of adenine in the agar substrate of the inoculum upon the following response to adenine in liquid medium.

Test object: *Mycena flavo-alba*, No. 315.

The substrate of the inoculum consisted of ordinary synthetic medium plus 1.5 % thoroughly washed agar. Each plate contained 10 ml of the medium with or without 0.1 mg adenine.

Substrate of the inoculation cultures	Substrate of the flask cultures	Dry weight of mycelium, in mg	
		After 25 days	After 45 days
No adenine	No adenine	2.7±0.4	14.8±1.1
With adenine	No adenine	2.4±0.3	10.3±1.5
No adenine	With adenine	12.7±1.2	81.4±4.5
With adenine	With adenine	19.3±1.4	84.1±5.3

in all three strains; no correlation could be found between the growth rate in general and the age of the inocula, valid for the three strains.

In another, quite small, experiment the inocula were taken from cultures grown on agar with the same synthetic nutrient solution as that used in the flask cultures. Some of these agar plate cultures contained adenine (0.1 mg per plate), others not. The inocula from the adenine-containing plates started to grow somewhat faster than the others, when transferred to flasks with synthetic nutrient medium, but this difference soon disappeared (Table III).

Summarizing the results of these attempts of estimating the significance of the "inoculation factor", it can merely be said that they show the importance of using inocula (inoculation mycelia) of the same age throughout every experiment. Differences in age and substrate of the inocula cannot, however, account for the great variations observed in experiments separate in time but otherwise identical. The cause of these variations is probably to be found in the living material itself.

It was then investigated, whether the nature of the carbon and nitrogen sources affects the response to adenine. It appeared that *Mycena flavo-alba* in a medium of the ordinary composition but with glucose exchanged for some other carbon source still produced a considerably better initial growth with, than without, adenine, irrespective of the nature of the carbon compound used (Table IV). Since *Mycena flavo-alba* is not able to grow with C_2 and C_3 com-

Table IV. The growth of *Mycena flavo-alba*, No. 315, in a synthetic nutrient medium with different carbon sources, with and without adenine.

The nutrient solution was the ordinary one, although glucose was exchanged for various other organic compounds according to the table below. Incubation time 25 days.

Carbon source, 500 mg per flask	Dry weight of mycelium, in mg	
	No adenine added	300 µg adenine per flask
None	0.4±0	0.3±0
Glucose	3.4±0.2	18.4±0.8
Fructose	2.1±0.2	8.4±0.6
Mannose	3.5±0.2	14.9±0.7
Galactose	0.9±0.1	1.4±0
Sucrose	2.3±0.2	4.4±0.3
Maltose	5.8±0.4	25.9±1.3
Lactose	2.2±0.2	9.2±0.6
Glycerol	0.7±0	0.6±0
Ethanol	0.3±0	0.5±0

pounds, some other experiments were performed with *Mycena rubromarginata*, *Polyporus abietinus*, and *P. annosus* as test objects, using glycerol and ethanol as carbon sources. *Polyporus abietinus* only proved capable of utilizing these two compounds for growth, whereas *Polyporus annosus* was the only one able to grow on sucrose. Adenine caused an increased mycelial production in all cases, rather small and doubtful, however, in the case of glycerol (Table V). None of these fungi was able to grow with ammonium tartrate as the single source of carbon.

When different nitrogen sources were tested, it turned out that *Mycena flavo-alba* was capable of utilizing all of them except nitrate, and in all cases adenine caused an increase in the rate of growth (Table VI).

Furthermore, the adenine effect was apparent when the growth rate of the mycelium was enhanced by a supplement of organic acids (Table VII). In *Mycena flavo-alba* all such acids tested (except citric acid) considerably promoted growth; in *Polyporus annosus*, particularly glutamic and aspartic acid.

The temperature factor also appeared to be without any great importance in this connection, at least within the limits tested (Table

Table V. The growth of four hymenomycete species in a synthetic nutrient medium with different carbon sources, with (+) and without (—) adenine, 300 μg per flask.

Species	Time in days	Dry weight of mycelium per flask, in mg									
		Glucose		Maltose		Sucrose		Glycerol		Ethanol	
		−	+	−	+	−	+	−	+	−	+
Polyp. abietinus	20	43.2	60.2	13.8	15.5	−	−	−	−	25.3	38.1
	30	118.0	147.4	16.4	23.0	1.3	1.3	33.2	39.2	−	−
Polyp. annosus .	20	38.1	47.3	72.3	80.1	−	−	−	−	2.4	2.9
	20	21.8	29.6	−	−	21.8	35.0	1.6	1.3	−	−
Mycena flavo-alba	25	2.2	19.7	6.3	27.8	−	−	−	−	0.3	0.3
	25	3.0	16.6	3.4	17.9	0.8	1.1	0.9	0.6	−	−
M. rubromarg. .	25	4.2	6.9	6.6	11.6	−	−	0.7	0.8	0.3	0.3

Table VI. The growth of *Mycena flavo-alba*, No. 315, in a synthetic nutrient medium with different nitrogen sources, without and with adenine.

The nutrient solution was the ordinary one, although ammonium tartrate was exchanged for various other compounds in some series according to the table below. NZ-case: tryptic digested casein (Sheffield Farms Co., Inc.).

Source of nitrogen, mg per flask	Dry weight of mycelium per flask, in mg			
	25 days		35 days	
	No adenine	300 μg adenine per flask	No adenine	300 μg adenine per flask
Ammonium tartrate, 125	3.2	17.6	11.2	54.7
KNO_3, 138	0.7	0.5	1.2	1.3
Asparagine, 90	2.0	9.2	4.6	27.2
Glycine, 102	1.2	2.2	1.7	4.1
Ammonium tartrate, 63, + glycine, 51	1.3	10.7	5.9	50.2
Ammonium tartrate, 63, + NZ-case, 20	48.2	72.2	122.0	145.5
Ammonium tartrate, 60, + NZ-case, 200	53.0	82.9	156.9	218.3

Table VII. The effect of various organic acids on the response of *Mycena flavo-alba*, No. 315, and *Polyporus annosus* to adenine.

The basal medium differed from that described on p. 560 in so far as the ammonium tartrate was exchanged for ammonium nitrate (2.17 g per liter). The organic acids were autoclaved separately in neutralized solutions. Each acid was present in the medium at a concentration of 0.1 mole per liter (2.5 millimole per flask). The flasks with adenine contained each 300 μg.

Organic acid added	Dry weight of mycelum, in mg			
	Mycena flavo-alba (25 days)		*Polyporus annosus* (15 days)	
	Without adenine	With adenine	Without adenine	With adenine
None	3.2±0.7	8.8±0.7	2.8±0.3	3.7±0.4
Glutamic acid	8.6±1.4	–	25.5±2.8	35.2±3.3
Aspartic acid	9.0±1.1	36.9±4.8	15.2±1.4	19.1±1.3
Succinic acid	9.2±1.7	41.1±2.5	6.3±0.3	8.7±1.4
Fumaric acid	7.2±0.6	35.6±4.5	5.1±0.7	6.7±0.3
Malic acid	7.6±1.8	39.8±3.6	4.6±0.4	8.6±1.9
Tartaric acid	6.4±1.5	32.9±4.9	5.9±0.5	8.2±1.0
Citric acid	1.7±0.2	14.4±2.1	0.8±0.2	1.3±0.2

Table VIII. The growth of *Polyporus abietinus* and *Mycena flavo-alba*, No. 315, in the synthetic nutrient solution at various temperatures, without and with adenine.

Species	Temperature	Time in days	Dry weight, in mg	
			No adenine	300 μg adenine per flask
Polyporus abietinus	+20°C	22	69.2±3.1	83.9±2.6
	+25°C	30	118.0±4.5	147.4±4.9
	+30°C	22	79.1±3.2	92.1±2.9
Mycena flavo-alba	+15°C	35	11.4±0.5	30.3±1.8
	+20°C	35	5.6±0.5	24.9±2.9
	+25°C	25	3.0±0.2	16.6±2.4

VIII). The response of *Polyporus abietinus* and *Mycena flavo-alba* to adenine was of the same relative strength at each of the three temperatures used.

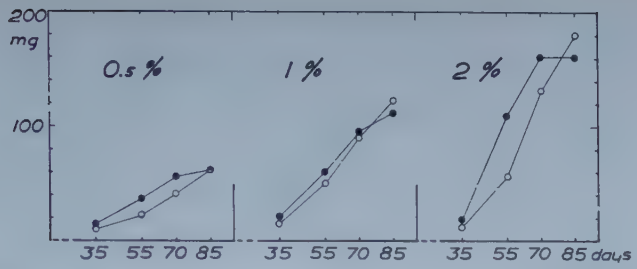

Fig. 4. Growth curves of *Mycena flavo-alba*, No. 315, cultivated in synthetic nutrient solution without adenine (open circles) or with 10 µg adenine per flask (filled circles). The amount of glucose per flask was 125 mg (0.5 %), 250 mg (1 %), or 500 mg (2 %). All sugar was consumed at the end of the experiment, i.e. after 85 days.

Thus, as far as can be judged from these experiments, the adenine effect seems to be independent of the composition of the medium and of the incubation temperature.

In most of the above experiments the incubation time has been rather arbitrary. Since the strength of the adenine effect may vary with time, it was considered profitable to produce complete growth curves of some of the species responding to adenine. Fig. 4 shows the course of these curves for three series of *Mycena flavo-alba*, cultivated with different amounts of glucose. The growth rate was so low that the number of cultures started did not permit a registration of growth up to autolysis. However, the last values obtained undoubtedly represent the apex of the three curves, since sugar determinations revealed that all the glucose of the medium was consumed.

While in *Mycena flavo-alba* (Fig. 4), as well as in *Polyporus abietinus* (Fig. 5), the curve without adenine finally caught up with the adenine curve, the corresponding curves in *Polyporus annosus* were clearly separate even at the top, the curve with adenine reaching a considerably higher maximal value than that without adenine (Fig. 6).

It is evident from these curves that the increase in initial growth rate caused by adenine is mainly to be regarded as a shortening of the lag phase, since the following rate of growth is about the same both without and with adenine. Furthermore, it seems quite clear that adenine in certain cases also causes an increase in the total production of living matter. The possibility must be considered that cases also occur, where adenine does not affect the lag phase or the rate of growth, but only the total mycelial production. There seemed, therefore, to be sufficient reason for studying the growth curves – with and without adenine added—in some fungi, which did not

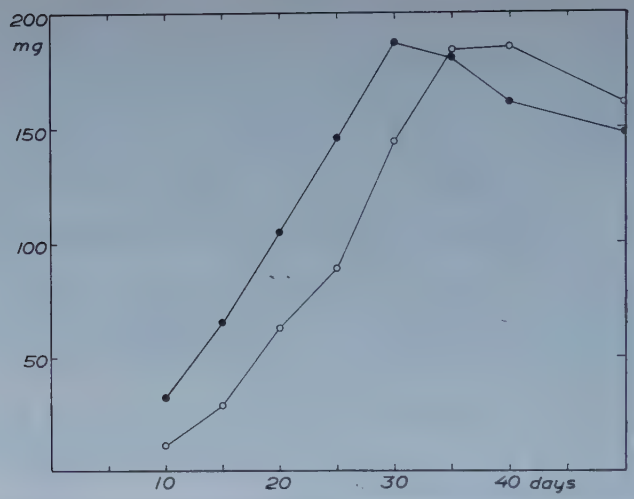

Fig. 5. Growth curves of *Polyporus abietinus* cultivated in synthetic nutrient solution without adenine (open circles) or with 1 mg adenine per flask (filled circles).

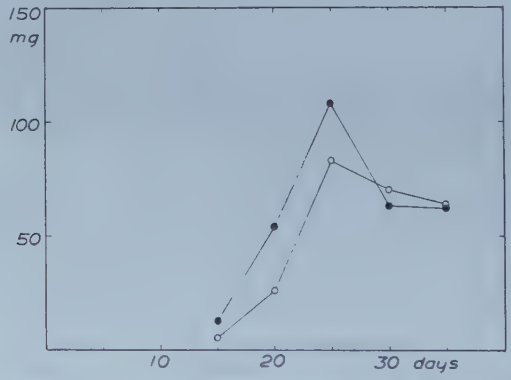

Fig. 6. Growth curves of *Polyporus annosus* cultivated in synthetic nutrient solution without adenine (open circles) or with 1 mg adenine per flask (filled circles).

respond to adenine in short-time experiments. Such growth curves are described in the following chapter.

B. Fungi whose growth rate is not affected by adenine.

Lentinus lepideus and *Peniophora fraxinea* were selected as representatives of species not responding to adenine by an enhanced initial rate of growth. The growth curves obtained (Fig. 7 and 8) gave the interesting result that in one of the two fungi, *Lentinus lepideus*, the total amount of mycelium produced was a good deal greater in the

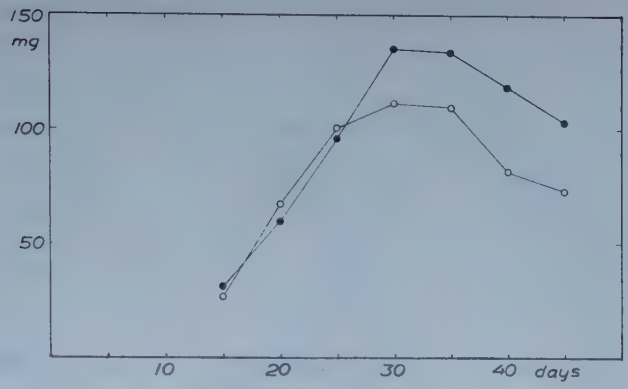

Fig. 7. Growth curves of *Lentinus lepideus* cultivated in synthetic nutrient solution without adenine (open circles) or with 300 μg adenine per flask (filled circles).

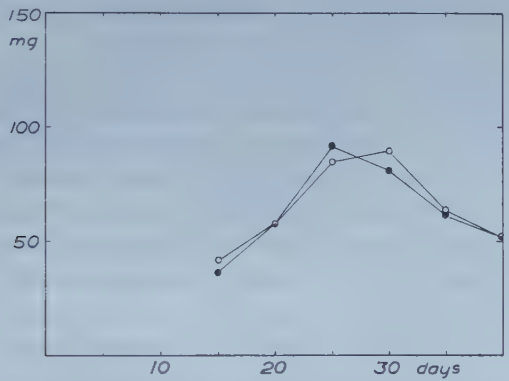

Fig. 8. Growth curves of *Peniophora fraxinea* cultivated in synthetic nutrient solution without adenine (open circles) of with 1 mg adenine per flask (filled circles).

series with adenine than in the control, although the growth rate was about the same in both series. This difference was still apparent during the period of autolysis following the total consumption of glucose. In *Peniophora fraxinea*, on the other hand, adenine produced no effect whatsoever on lag phase, growth rate in general, or total mycelial production.

As regards *Lentinus lepideus* the result was corroborated by a subsequent experiment in which the inocula were taken from cultures of different ages (Fig. 9). In all three series with adenine about 130 mg mycelium were produced per flask, compared to about 105 mg in the three control series. Concerning the growth rate, however, certain surprising features of the curves must be pointed out. With inocula 5 and 15 days old the growth rate in the adenine series corresponded

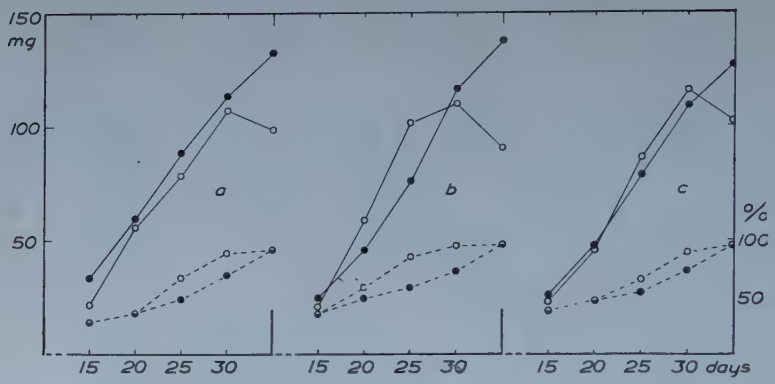

Fig. 9. The unbroken lines represent growth curves of *Lentinus lepideus* cultivated in synthetic nutrient solution without adenine (open circles) or with 300 μg adenine per flask (filled circles). The broken lines show the corresponding amounts of glucose consumed, in percentage of the initial quantity (500 mg per flask). The age of the inocula was: (*a*) 5, (*b*) 10, and (*c*) 15 days.

fairly well with that in the control series; with 10-day-old inocula, on the other hand, the growth rate in the adenine series was considerably inferior to that in the control series during a period of at least ten days. In this latter case the dry weight of the mycelia after 25 days was *c.* 30 per cent higher in the control flasks than in the flasks with adenine. After 25 days, however, the state of things was almost exactly the reverse.

Determinations of glucose made at regular intervals confirmed that the mycelium lived more economically with adenine than without, at least during the later part of the experiment. This explains the difference in the final values of the mycelial production, but gives no clue to the inhibitory effect of adenine in the flasks with ten days old inocula.

The same result was obtained when ammonium tartrate was exchanged for asparagine as the nitrogen source, except that the effect of adenine was considerably stronger, and also expressed itself by an increased growth rate throughout the experiment (Fig. 10). The maximal amount of mycelium produced (and consequently also the corresponding economical coefficient) was exactly the same in the control series with asparagine as in that with ammonium tartrate; with adenine, however, the maximal yield in the asparagine series reached a value of 180 mg per flask, compared to 145 mg per flask in the ammonium tartrate series, and an economic coefficient as high as 0.37 was recorded.

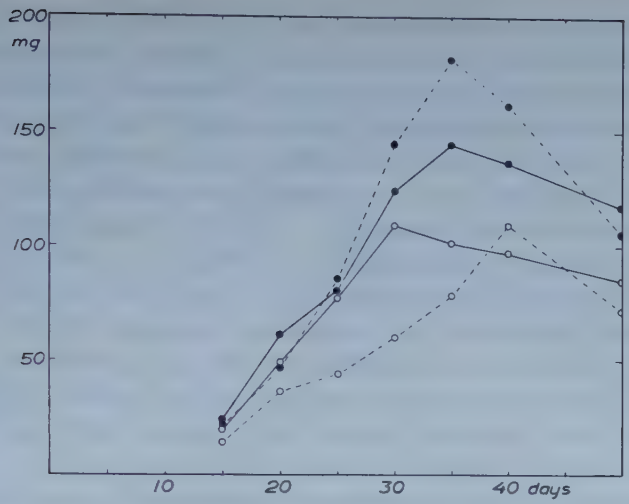

Fig. 10. Growth curves of *Lentinus lepideus* cultivated in synthetic nutrient solution without adenine (open circles) or with 300 μg adenine per flask (filled circles). The nitrogen source was ammonium tartrate (unbroken lines) or asparagine (broken lines).

Discussion.

Since adenine is assumed to be a metabolite essential to all organisms, the positive response of certain fungi to added adenine should in the first place be interpreted as an expression of a partial deficiency, a heterotrophy, in the biosyntesis of this metabolite. The degree of deficiency varies not only from one species to another, but also within the species, as could be concluded from the tests with a number of strains of *Mycena flavo-alba*, where the strength of the response to adenine differed considerably from one strain to another. Such an intraspecific variation has been observed earlier in several higher fungi as regards vitamin heterotrophies, e.g. thiamin heterotrophy in *Boletus granulatus* (Melin & Nyman 1941), *Clitopilus prunulus* (Melin & Norkrans 1942), and *Lenzites trabea* (Lilly & Barnett 1948). In the case of adenine, however, this variation seems to be unusually great, and the picture is further complicated by the changes in the response to adenine which can be observed in single strains during the course of time.

It is certainly useless to speculate on the cause of this variability in the sensitivity to adenine. As regards the biochemical background we know that adenine is involved in essential processes, more than perhaps any other organic substance; as regards the genetical back-

ground of this natural adenine heterotrophy nothing is known as yet. It should be emphasized, however, that a change in the requirement for externally supplied adenine may reflect not only a change in the rate of biosynthesis of this particular substance, but also a change in the amount of adenine needed in cell metabolism. This amount may increase or decrease as a consequence of alterations in various systems where adenine is playing a role (see FRIES 1951).

The lowest active concentration of adenine was found to be 3 μmoles per liter, e.g. 10 μg per flask. This is in line with the results obtained with purine-requiring mutants of *Neurospora crassa* (PIERCE & LORING 1945) and *Ophiostoma multiannulatum* (FRIES 1945), where the lowest purine concentration causing a visible growth is *c.* 20 μmoles and 1 μmoles per liter, respectively. The lower limit of the optimal concentration was found to lie at *c.* 30 μmoles per liter in *Mycena flavo-alba* and *M. rubromarginata*, as compared with *c.* 50 μmoles per liter in the case of adenine-less *Ophiostoma*. The effect of guanine and hypoxanthine on spore germination and early growth in *Phycomyces*, studied by ROBBINS & KAVANAGH (1942) and ROBBINS, KAVANAGH & KAVANAGH (1942), was evident at a concentration as low as 0.3 μmoles per liter, e.g. 1 μg per 25 ml. Optimal effect was obtained with a ten times higher concentration. An even higher activity of a purine base on the growth of a fungus was observed by YUSEF (1953) in *Polyporus immitis*, which responded to 0.04 μmoles per liter of adenine, maximum effects being secured with between 4 and 20 μmoles per liter.

It is hard to understand why one fungus, *Polyporus abietinus*, requires about 100 times more of adenine for growth stimulation than another, rather closely related, fungus, *Polyporus immitis*. One possibility may be that in the former case the partial deficiency is concerned with all the various functions of adenine in the organism, in the latter case only with a minor part of these functions, e.g. those where adenine plays a role as the constituent of a co-enzyme (the pyridine-nucleotides, co-enzyme A, etc.).

In all cases tested, adenine could be exchanged for adenosine, which produced a higher (*Polyporus annosus*), the same (*Polyporus abietinus*), or a lower effect (*Mycena flavo-alba, M. rubromarginata*). Hypoxanthine, guanine, and guanosine showed activity to the polypores but not to the Mycenae. These substances are to be considered either as possible precursors to adenine, or as metabolites necessary by themselves and, like adenine, synthesized at too slow a rate. (The

response of *Mycena flavo-alba* to hypoxanthine, reported earlier (Fries 1951), was weak, and appeared to be somewhat irregular.)

Several cases have been described in the literature, where the requirement for a particular growth factor appears only under special external conditions. Thus, *Rhodotorula sanniei* requires thiamin when grown with glucose, but not with glycerol (Fromageot & Tchang 1938), and *Pellicularia koleroga* requires biotin in a sucrose but not in a glucose solution (Mathew 1952). Pyridoxin appeared necessary for a mutant of *Neurospora sitophila* under all circumstances except when ammonium served as the source of nitrogen (Stokes, Foster & Woodward 1943). Temperature has also been claimed to influence the requirement for various growth factors (Mitchell & Houlahan 1946, Barnett & Lilly 1948, L. Fries 1953). As far as the effect of adenine on the growth rate is concerned, the choice of carbon and nitrogen sources as well as the incubation temperature did not essentially influence the results. The age of the inoculation material seemed to be of some importance, the younger inocula responding somewhat more strongly to adenine than the older ones.

The growth curves revealed that the primary effect of adenine upon growth chiefly consisted in a shortening of the initial lag phase, in some cases combined with an increase in the rate of the following growth. In certain cases adenine then also produced an enhanced total yield of mycelium. This less easily demonstrated, but interesting effect, which shows up during the end of the experiment, may or may not be combined with the first-mentioned effect on lag phase and growth rate. In one instance adenine even suppressed the growth rate of the fungus during a long period of the experiment, but caused a considerably higher final yield of mycelium. It is indeed a question of definition whether adenine in that case should be looked upon as a growth-promoting substance or not.

A higher final production means a more efficient utilization of the carbon source present in the medium, e.g. an increased value of the economic coefficient (the ratio between the quantity of mycelial dry matter formed and the quantity of carbon source consumed). Adenine can thus be included among the substances known to increase this coefficient. Although most essential growth factors seem to give a higher economical coefficient in optimal than in suboptimal concentration, this effect is particularly striking in the case of zinc (Richards 1899, Ono 1900, Foster & Waksman 1939). Ordinarily,

however, such an effect is coupled with an enhanced rate of growth, as in the thiamin-induced promotion of growth and production in certain strains of *Lenzites trabea* (Lilly & Barnett 1948). In *Polyporus annosus* adenine increased the economic coefficient from 0.17 to 0.22, in *Lentinus lepideus* from 0.22 to 0.28, without affecting the growth rate in the latter case.

The relatively large amount of adenine which is necessary for creating a measurable effect, indicates that adenine is required not only as a co-enzyme constituent, but that it may serve as starting material for the biosynthesis of several or perhaps all cell metabolites containing adenine, including the nucleic acids. A considerable increase in the nucleic acid content of the cells seems to be a prerequisite for the intensive protein synthesis, which occurs during the logarithmic phase of the growth (cf. Malmgren & Hedén 1947). If adenine is the factor limiting the rate of nucleic acid production, it is understandable why the supply of this substance induces a shortening of the lag phase. The lower economic coefficient established in certain cases without addition of adenine may be the consequence of an insufficient access to ATP, since this energy-rich adenine-derivative functions as one of the most important links between the oxydative and the synthesizing systems in the organism.

Summary.

The promoting effect of adenine on the growth of certain higher fungi, viz. *Polyporus abietinus*, *P. annosus*, *Mycena flavo-alba*, and *M. rubromarginata*, was apparent under all experimental conditions tested: with various carbon and nitrogen sources, on semi-solid as well as in liquid media, at different incubation temperatures, and with inocula of varying age. The effect appeared to consist mainly in a shortening of the lag phase, the following period of growth being less, or not at all, affected. Nine strains of *Mycena flavo-alba* were all promoted by adenine, the strength of the response, however, differing considerably from one strain to another, and also changing with time. Adenine was also found to enhance the economic coefficient in some species (*Lentinus lepideus*, *Polyporus annosus*) without necessarily affecting lag phase or growth rate. The response to other purines and purine derivatives was also studied, and appeared to vary with the species.

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THE TAXONOMY OF HEXAPLOID WHEAT.

BY

JAMES MAC KEY.

(Wheat and Oat Department, Swedish Seed Association, Svalöf, Sweden.)

The taxonomy of agricultural plants offers special difficulties. When breeding with a set purpose is begun by man, the isolating mechanisms are broken down and thus also the natural species barriers. The valuable taxonomic characters lose much of their significance with an irregular geographic distribution. In crops, grown for one special purpose, they also tend to be lost. The breeding here aims at a certain ideal type, i.e. works towards uniformity. Even a strong natural counter-selection does not prevent man from striving towards this goal and under trying ecological conditions the crop is often entirely dependent on man for its reproduction from season to season. Under such conditions, it is a rather delicate task to elaborate a more detailed classification scheme which will also be of value in the future (cf. Åberg, 1943).

Wheat, and especially the hexaploid wheat, is one of the plants in question, whose taxonomy will become more and more critical. A revision of the classification system may be justified from a modern genetic and agronomic point of view. As a suitable basic point for the discussion, the recent contributions to wheat systematics given by Schiemann (1948), Schrimpf (1951) and Mansfeld (1951) are chosen. For the first grouping of the 6x-wheats, the scheme of Schiemann (l.c.) has been generally accepted. She divides the *Triticum* section *Speltoidea* Flaksb. into four distinct species:

Spelt 6x-wheat:	*T. spelta* L.
	T. macha Dek. et Men.
Free-threshing 6x-wheat:	*T. aestivum* L., em. Fior. et Paol.
	T. sphaerococcum Perc.

A less important comment may first be given; the nomenclature is not completely correct. FIORI and PAOLETTI (Fl. Ital. I (1896) 107) are not, according to HYLANDER (1945), the emendators for the use of the name *T. aestivum* in the sense of common bread wheat only. Besides the incorporation of *T. aestivum* L. and *T. hybernum* L., they included some $4x$-wheat types in their *aestivum* concept as well. Again according to HYLANDER (personal communication), *T. aestivum* L., em. HAYEK et MARKGRAF should be the correct synonym for *T. vulgare* VILL., ampl. HOST, the name which has been most widely used for the common bread wheat by geneticists and agriculturists the world over and which now according to the International Code of Botanical Nomenclature (Utrecht, 1952) is declared a *nomen illegitimum* (cf. SCHIEMANN, 1949).

In her scheme above, however, SCHIEMANN (1940; l.c.) includes more than the common wheat in the species *T. aestivum*. *T. compactum* HOST is here incorporated as grex *aestivo-compactum* SCHIEM. The correct denomination should thus be *T. aestivum* L., em. SCHIEM. for the species and *T. aestivum compactum* THELL. for the subgroup, since THELLUNG (1918) was the first one to incorporate common and club wheat under the name *aestivum* (his s. str.). The *aestivum* concept of SCHIEMANN is thus synonymous with *T. vulgare* VILL., ampl. HARZ (1885).

Neither HARZ nor THELLUNG gave any argument supporting their incorporation of *T. vulgare* VILL., ampl. HOST and *T. compactum* HOST into one group which was made systematically equivalent to *T. spelta* L. SCHIEMANN (1948, p. 53) gives however, distinct reasons and writes, *inter alia:* "Seit NILSSON-EHLE indessen 1909—1911 nachgewiesen hat, dass der Binkelweizen sich von *T. aestivum* L. monofaktoriell nur durch das dominante Gen *C* unterscheidet, lässt sich diese Abtrennung als Art nicht aufrecht erhalten." This statement is quite in accord with the genetic concept of species barriers. This step towards a more modern principle of systematic grouping implies, however, that her system is inconsistent. While the key gene separating *T. vulgare* and *T. compactum* is *C* (NILSSON-EHLE, 1911) on chromosome XX (UNRAU, 1950), *T. vulgare* is separated from *T. sphaerococcum* by the factor *S* (ELLERTON, 1937) on chromosome XVI (SEARS, 1946). Recent investigations by MAC KEY (1954) further show that the decisive characteristics separating *T. vulgare* and *T. spelta* are governed by one gene *Q* only which, according to SEARS (1944), is situated on chromosome IX. Finally,

it has recently been proved that *T. macha* cannot have an independent origin as postulated by Chin and Chwang (1944). Sachs (1953) shows the *macha* wheat to be closely related to the other species of 6*x*-wheat. The occurrence of hybrid semi-lethals is not paralleled with the taxonomic characteristics. How these are inherited is still unknown, since no attempts were made to eliminate interfering genes of non-taxonomical interest. The inheritance, however, does not seem to be too complicated.

Thus, there are no genetical reasons for considering *T. vulgare* more closely related to *T. compactum* than to the other species. Mac Key (1954) is of the opinion that *T. spelta* is even more closely related phylogenetically to *T. compactum* than is *T. vulgare*. Cytological evidence can be found in data given by Thompson and Robertson (1930). They studied the frequency of meiotic cells with univalents and found it to be 4.0—4.4 per cent in pure strains of *T. vulgare*, *T. compactum* and *T. spelta*. In F_1 these rates increased to 42.0 per cent when crossing *vulgare* × *spelta*, to 34.0 per cent for *vulgare* × *compactum*, but only to 12.5 per cent for *spelta* × *compactum*. The higher chromosome affinity of the last cross, though misinterpreted by the original investigators, must indicate a closer interrelation. The serological analysis of Zade (1914) gives additional corroboration in the same direction. According to *i.a.* Schiemann herself (1932, 1948) *T. compactum* is further to be considered as an older wheat than *T. vulgare*. Thus, it is illogical to incorporate the *compactum* wheat as a subgroup under the younger *vulgare*—a fundamental criticism of the consequences of the present botanical nomenclature rules, already given by the Nestor of modern wheat taxonomy (Schulz, 1913).

It is thus obvious that Schiemann's above-cited scheme for the hexaploid wheat hardly means an improvement. From the above information concerning the genetic background of the taxonomical differences, it is further evident that the 6*x*-wheat should not be divided into several distinct species. There are no real species barriers within the hexaploid wheat. The crossability is good and the ability of the chromosomes to pair at meiosis may not be inferior in crosses between the different subgroups than within them. Thus, Hollingshead (1932) records that the frequency of meiotic cells with univalents sometimes reaches 40 per cent in *vulgare* × *vulgare* crosses, i.e. the same level obtained by the most distinct intergroup crosses (cf. Thompson and Robertson, l.c.). The chromo-

some affinity is apparently independent of the limits of the old $6x$-species.

It is far from a new idea to consider all the hexaploid wheats as one species only. Such an incorporation was earlier proposed by Flaksberger (1915) under the name *T. speltoides*, by Thellung (1918) using *T. aestivum* sens. ampl., and by Kajanus (1927) who proposed *T. obtusatum*. According to the nomenclature rules, *T. aestivum* L., em. Thell. is to be regarded as the *nomen legitimum* when considering all hexaploid wheats as comprising one species only.

The division of *T. aestivum* L., em. Thell. into subgroups is a delicate task. The polyploid constitution implies an increased variation; but because of the high buffering ability of hereditary systems, based largely on gene reduplications, this rich variation is restricted to a narrower morphological frame (cf. Mac Key, 1954). A genic system of small and continuous changes is, however, not *in se* the big stumbling-block in the wheat taxonomy. The real difficulties are to be found in the fact that there is no sharp grouping of characters, no effective isolation. The independent recombination is already obvious from studies of indigenous wheat material which led Vavilov (1922) to set up his law of homologous series in variation. When one considers the present international cooperation of wheat breeders, and the fact that it is highly encouraged by the Food and Agriculture Organization (FAO) of the United Nations, it is then obvious that these difficulties will not diminish in the future. Underdeveloped countries will cross their primitive, taxonomically distinct races with highbred uniform foreign varieties; and countries already with an advanced plant breeding will search for unexplored types to be used in their crossing programs. It is quite possible that the geographical races which still exist will soon disappear in practice.

It is also symptomatic that every consistent system of wheat classification is more or less a direct copy of some Mendelian recombination scheme. It is difficult to substitute the old artificial system of Körnicke (1885), entirely based on morphological characters, with a more natural classification scheme. In its original form, his subdivision of *T. vulgare* may be presented as shown in Table I.

The principle of morphological grouping has been repeatedly reestablished and even the most bitter adversaries have not been able to avoid it for the detailed final subgrouping. The purely morphological system of wheat classification is presented by Mansfeld

Table I. The subdivision of *Triticum vulgare* according to Körnicke (1885).

		Head awnless		Head awned	
		Glabrous	Pubescent	Glabrous	Pubescent
Head white	Kernels white	var. *albidum* Al.	var. *leucospermum* Kcke	var. *graecum* Kcke	var. *meridionale* Kcke
	Kernels red	var. *lutescens* Al.	var. *velutinum* Schübl.	var. *erythrospermum* Kcke	var. *Hostianum* Clem.
Head red	Kernels white	var. *alborubrum* Kcke	var. *Delfii* Kcke	var. *erythroleucon* Kcke	var *turcicum* Kcke
	Kernels red	var. *milturum* Al.	var. *pyrothrix* Kcke	var. *ferrugineum* Al. (awns red) var. *sardoum* Kcke (awns black)	var. *barbarossa* Al.
Head blue	Kernels red	–	var. *cyanothrix* Kcke	var. *caesium* Al.	var. *coeruleovelutinum* Kcke
Head black	Kernels red	–	var. *nigrum* Kcke	–	var. *fuliginosum* Al.

(1951) in its most recent form. His subdivision of *T. aestivum* L., em. Schiem. is based on the following characters and their recombinations:

1. Awnedness ..... awned — awnless.
2. Glume pubescence ..... pubescent — glabrous.
3. Lemma hoodedness (*inflatum*) .... normal — *inflatum*.
4. Awn length..... long — short.
5. Head branching ..... simple — branched.
6. Stem solidness ..... hollow — pithy.
7. Ligula appearance ..... present — absent.
8. Glume colour ..... distinct colour — grey — chocolate — blackish — black dotted — black striped — black margined.
9. Awn colour ..... identical to glume colour — black.
10. Glume shape ..... pointed — truncated.
11. Head density ..... lax — dense — club.

The system permits Mansfeld to arrange the common and club wheats into more than 400 varr. often with long and complicated

Latin names. From phylogenetic, geographic, ecologic and agronomic points of view, his systematically admirable scheme gives more disorder than order, however. The way in which *T. compactum* is incorporated into the *vulgare* system, is further a definite impairment in comparison with older schemes. The pleiotropic effect of the phylogenetically important gene *C* is too pronounced to justify its position in the scheme as the final separating factor.

Even if it is easy to make a morphological classification consistent, its limited use is apparent. Körnicke's system was built upon a restricted variation (European varieties and the relatively few botanical garden collections of his time) and could therefore be made simple enough to be handled easily and to be useful within the limits of the material on which it was based. In its broader application, a morphological system definitely tends to be too complicated and this is especially obvious in arranging indigenous varieties composed of several biotypes. The system is, however, excellent to apply in a key to a limited number of purebred varieties. It has been successfully used for that purpose by Clark *et al.* (1922, 1935, 1942) for example for American, and by Voss (1933) for German varieties. In such a case, the system must be adapted to the variation of the material to be arranged. A general system such as that of Mansfeld would be of little or no value. A morphological classification can thus hardly be the sole basis of an acceptable system comprising all 6*x*-wheats in the world.

From what has been said above, it is quite understandable that it was above all the scientists working with the multiform and mixed wheats of Asia who tried to build up systems based on phylogenetic, geographic, ecologic and also agronomic aspects. The most important attempt to elaborate a natural system of this kind was made by Flaksberger (1929, 1935, 1939). His scheme for *vulgare* wheat was later completed and revised by Gökgöl (1939), Schiemann (1948) and Schrimpf (1951). The result is definitely of more interest than the Mansfeld system but it has an inherent weakness. It is impossible to make the different groups sufficiently sharp to allow a correct classification of individual samples. Lange - de la Camp (1939), Lein (1949) and others who tried to use the natural system in the classification of wheat collections, found it impossible in practice and this even on primitive material to which it should be especially adapted. Even in its present form, with the recent revisions of Schiemann (l.c.) and Schrimpf (l.c.), it can hardly be said to be

complete. The variation of the wheat in the world is not sufficiently known by one person only. The schemes thus tend to be disproportional. In addition, the priority of an older name is so ignored for the sake of consistency at the various infraspecific levels that one must state that a correct and fully practicable natural system of wheat classification is still lacking.

From the above it seems impossible to elaborate a more detailed subgrouping of the 6*x*-wheat species which is entirely free from objections. The use of an extremely simple classification system is undoubtedly the only possibility of avoiding imperfections. When discussing the taxonomy of barley, Åberg (1943) and Brücher and Åberg (1950) reached the same conclusion. For agricultural plants such as barley and wheat, they recommend a restricted use of Latin names. The second subdivision of a species should be based on the biotype. The present writer is in full agreement with this proposal. The comprehensive recombination work at the different breeding stations all over the world, the production of new hereditary factors by means of artificial induction of mutations, the introduction of new genes or gene blocks from other species by means of artificial syntheses, and, finally, the discarding of characters of negative or no agronomic value, all contribute to make the limits between the different biotypes the only natural ones in a self-fertilizing plant. Here, however, the biotype concept can conveniently be replaced by the agronomic variety (the cultivar). For arranging the numerous indigenous or bred varieties, the taxonomist should follow the plant breeder. He arranges his basic material country-wise as to its primary origin. This gives him a handy system which takes ecological adaptation and breeding values fairly well into consideration, and a system which, in contrast to a morphological or phylogenetical principle of classification, will improve by continued plant breeding. The FAO world catalogue of genetic stocks of wheat is an admirable example of this kind of classification, supported by registration committees of the different countries. A key based on morphological, or other distinct and easily determinable characters for the restricted variation and considerations of every single country, will then fulfil even the most exacting demands.

With this background, it seems justifiable to give the taxonomy of the hexaploid wheat a very simple form with regard to botanical nomenclature. The following system may suffice:

Species:	Subspecies:	Lower taxon:
Triticum aestivum L., em. THELL.	ssp. *compactum* (HOST) MAC KEY, n. comb. [*T. compactum* HOST pro spec., Icon. et descr. Gram. Austr. 4 (1809), p. 4, t. 7.]	the cultivars (= the agronomic varieties)
	ssp. *sphaerococcum* (PERC.) MAC KEY, n. comb. [*T. sphaerococcum* PERCIVAL pro spec., The Wheat Plant (1921), p. 321.]	
	ssp. *vulgare* (VILL., HOST) MAC KEY, n. comb. [*T. vulgare* VILLARS pro spec., Hist. Pl. Dauph. 2 (1787), p. 153; em. HOST pro spec., Icon. et descr. Gram. Austr. 3 (1805), p. 18, t. 26.]	
	ssp. *spelta* (L.) THELL.	
	ssp. *macha* (DEK. et MEN.) MAC KEY, n. comb. [*T. macha* DEKAPRELEVICH et MENABDE pro spec., Bull. appl. Bot. Gen. Pl. Breed. 5: 1 (1932), p. 14 et 38.]	

The subspecies[1] proposed correspond to those groups of 6*x*-wheat which according to older schemes generally were considered as independent species. The grouping is justified mainly for phylogenetical reasons and thus also for historical and archaeological considerations. The groups, however, are also morphologically distinct and the decisive characteristics are so profound as to be of definite agronomic significance. The genic differences are sharp, and since the genes *Q*, *C* and possibly *s* tend to counterbalance genes for a brittle rachis (cf. MAC KEY, 1954), cross products between the different subspecies will be fairly easy to classify. Only the crosses *compactum* × *sphaerococcum* and *spelta* × *macha* may result in segregates more critical for taxonomic considerations.

The exclusion of *T. compositum* VAV. which has been considered a distinct species of the 6*x*-wheat by VAVILOV (1935), is justified for

[1] MANSFELD's (1953) suggestion to call the infraspecific taxon of an agricultural plant subspecioid instead of subspecies has no enthusiastic supporter in the present writer. Such an attempt to preserve the subspecies concept of DU RIETZ will not counterbalace all the confusing situations, where one and the same species will include both subspecies and subspecioids and where the taxonomical distinction between the wild and cultivated type is made on an infrasubspecific rank.

taxonomical reasons. The lengthening of the spikelet internodes may occur independent of the decisive characteristics of the five subspecies of the above scheme. Taxonomically, *T. compositum* thus cannot be placed as an equivalent to them. The *compositum* character further occurs in connection with *spelta* crosses (Nilsson-Leissner, 1925) and certain speltoids (Mac Key, 1954) as a result of an environmentally modifiable genic disorder. This circumstance definitely impairs the taxonomical use of the character.

Another type not considered in the above scheme but classified by Flaksberger (1935) as a distinct hexaploid wheat species, is *T. vavilovi* (Tum.) Jakub. This wheat is too little known to allow a clear decision as to its position. From the sole study made on this wheat (Sachs, 1953), there does not seem to be any apparent reasons for its inclusion as a subspecies in the above scheme.

The new synthesized 6*x*-wheats which are produced in increasing numbers from different material (cf. McFadden and Sears, 1947; Isenbeck and von Rosenstiel, 1950) have not been considered in the above discussion on the taxonomy of hexaploid wheat. As "raw" hexaploids, many of them may certainly be even classified as distinct species. The final aim with such crosses, however, is to contribute new genes or gene blocks to the *T. aestivum* species. By repeated backcrosses they will therefore generally be incorporated into this species.

In contract to Schiemann's scheme (l.c., p. 1), the common and club wheats have here been considered to be taxonomically equivalent. The reasons for this return to a previous opinion are discussed above. Further, the name *vulgare* is retained for the common bread wheat. This choice of name, however, is not in accord with the article 35 of the Int. Code Bot. Nom. (Utrecht, 1952). The correct name of the subspecies including the nomenclatural type of the epithet of the species should in the present case be *T. aestivum* L., em. Thell. ssp. *aestivum*—without citation of an author's name after the subspecies epithet. This, however, results in the subspecies in question being ambiguously defined (cf. a similar objection made by Hylander, 1953). Thellung (1918) included both common and club wheat in his *T. aestivum* ssp. *aestivum*, the present writer can only accept the first type under this name. How should this difference in opinion be shown with the present rule of nomenclature? Article 35 cannot be followed as soon as there are more than one conception of the limits of the subspecies which includes the nomen-

clatural type of the species. Under such circumstances, the article 35 must be cancelled by the code itself, since article 4 says that "the essential points in nomenclature are", *inter alia*, "to avoid or to reject the use of forms and names which may cause error or ambiguity", and article 75 says that "a name of a taxon must be rejected if it is used with different meanings, and so becomes a long-persistent source of error". Since the epithets are frequently used alone and the authors' names are often dropped in non-taxonomical publications, the name *vulgare* definitely is to prefer to *aestivum* for a subspecies including the common bread wheat only. In addition, in this sense the name *vulgare* even has absolute priority and avoids the inconsistency of denoting a species and one of its phylogenetically younger subspecies by one and the same name. Further, *vulgare* is the most widely used Latin name for common bread wheat and coincides better with the denomination of other languages.

Summary.

The existing classification systems of hexaploid wheat are examined from a genetic and agronomic point of view. None of them are free from objections and all are too complicated for an agricultural plant whose genic distribution and future evolution are entirely dependent on man. In conformity with earlier non-established systems, all hexaploid wheats are here considered as comprising one species only (*Triticum aestivum* L., em. Thell.). The species is divided into the subspp. *compactum*, *sphaerococcum*, *vulgare*, *spelta*, and *macha*. The system of a detailed subgrouping is discarded for the use of the agronomic varieties (the cultivars) directly, arranged according to the intention of the FAO World Catalogue of Genetic Stocks.

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MELOSIRA ISLANDICA AND M. GRANULATA IN THE SCANIAN LAKE RINGSJÖN.

BY

ASTA LUNDH-ALMESTRAND.

Melosira islandica O. Müller is according to Hustedt (1930 *a*, p. 254) very rarely seen. He mentions localities only from northern Europe. Bethge is the first researcher who has identified *M. islandica* from Sweden (Ringsjön), according to a private communication from A. Cleve-Euler. Ringsjön was for a long time the only known Swedish locality (Cleve-Euler 1938, p. 144). In a later work Cleve-Euler (1951, p. 24: *M. islandica* var. *typica*) states three more localities in Småland, Västergötland and Lappland. The alga is, however, still very rare. In the more than forty Scanian lakes investigated by the author as to planktic diatoms, it is absent except in Ringsjön.

The cells of *M. islandica* in Ringsjön are of two types, as is the case in other localities (Fig. 1). The cells with coarse pores have 12—13 pore rows in 10 μ and 10—13 pores in 10 μ in each row. The cells with fine pores have 13—14 rows in 10 μ and 16—20 pores in 10 μ. Hustedt (1930 *a* and *b*) gives for coarsely punctate cells 11—12 rows and 12—13 pores in 10 μ and for the finely punctate cells 14—16 rows and 16—18 pores in 10 μ. Thus, the form in Ringsjön does not show the extreme figures for the number of pore rows as is generally the case. Cleve-Euler also calls it a "transitional form" to ssp. *helvetica*. She has found the same number of pore rows as the author in the cells with coarse pores (1938, p. 148). She does not mention the finely punctate cells.

During the four years observed (Feb. 1947 to Dec. 1950) the alga has varied in frequency but has always had its highest development in the winter half-year (Nov.—April). The monthly samples studied are all collected in the easternmost part of Western Ringsjön near the

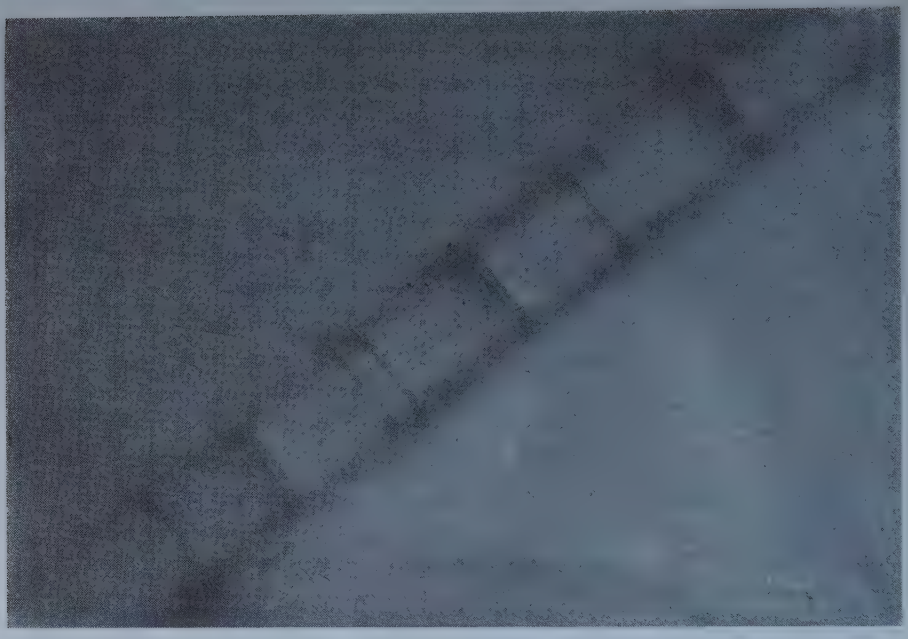

Fig. 1. Photomicrograph of *Melosira islandica* showing coarsely and finely punctate cell halves. Ringsjön 15.11. 1948. About 1,000 ×.

outlet from Eastern Ringsjön and reflect probably rather well the conditions in the last-mentioned part of the lake. Three complete winter periods have been studied, 1947—48, 1948—49 and 1949—50. During the first period the development of the alga was fairly inconsiderable, during the other two, however, extensive, especially in 1948—49 (Fig. 2). It also occurred abundantly in November—December 1950. During the after-winter of 1947 there was no high production, possibly owing to the hard winter climate. April 1947 showed a higher frequency, which may indicate a spring maximum, separated from a possible late autumn maximum by the cold winter months. (Cf. Hustedt 1930*a*, p. 254, and Cleve-Euler 1938, p. 151, with reference to ssp. *helvetica*.)

Thus *M. islandica* still occurs in abundance during favourable winter periods, as has been the case in preceding years. Trybom (1893, p. 17 and pp. 41—42) describes very fully the so-called "bloom" that a *Melosira* species used to cause in Ringsjön in the cold half-year. The winters of 1887—88 and 1892 were particularly troublesome. There was often a maximum in October. The fishermen complained of difficulties with their nets, which were slimed.

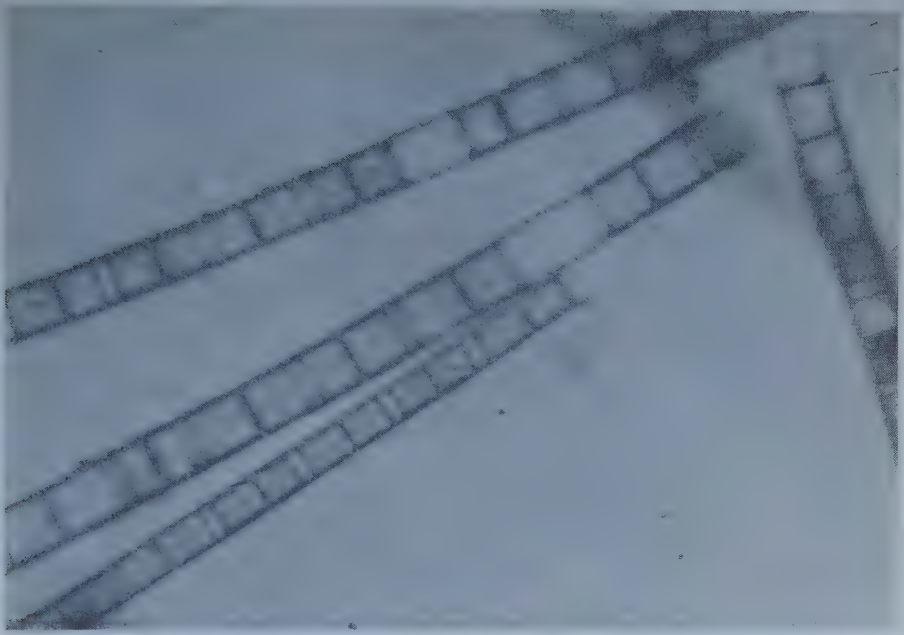

Fig. 2. *Melosira islandica* in mass development. Ringsjön 16.1. 1949. About 500 ×.

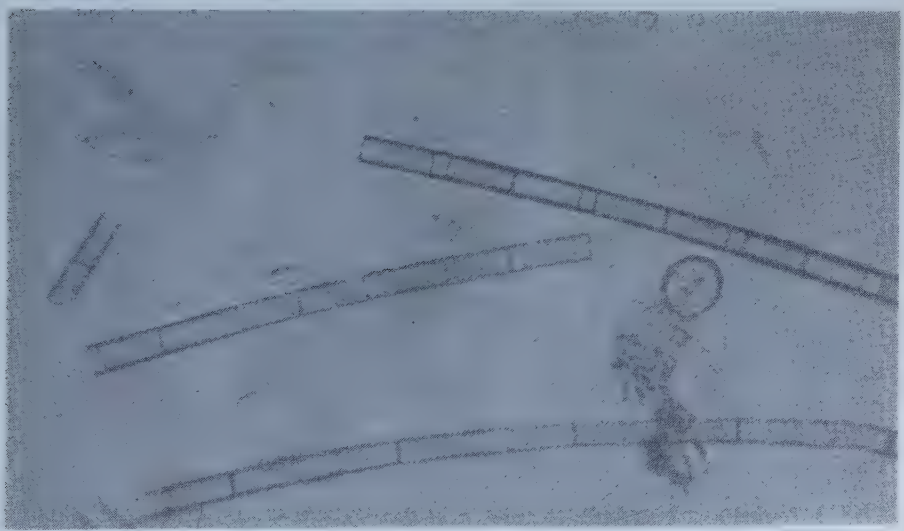

Fig. 3. *Melosira granulata* is only seldom provided with the characteristic end cells in the samples studied. Ringsjön 19.9. 1947. About 500 ×.

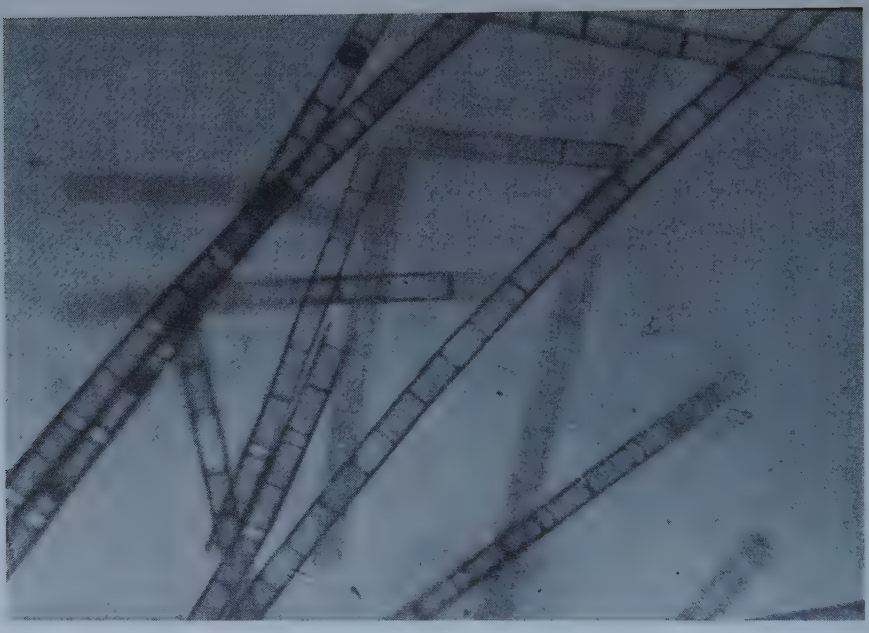

Fig. 4. Mass development of *Melosira granulata*. Sjöholmen 9.9. 1947. About 500 ×.

Also in spring *Melosira* could be abundant, e.g. in 1892. Trybom has not identified the *Melosira* species concerned, but in all probability it must be *M. islandica*. Cleve-Euler (1938, p. 147) also writes about mass vegetation of this diatom in Ringsjön.

Cleve-Euler calls *M. islandica* the "characteristic plant of Ringsjön". *M. granulata*, which is otherwise very common in lowland lakes, was not to be found in her plankton samples from the lake (l.c., p. 153). She also disputes Lemmerman's statement (1903—04, p. 93) of the occurrence of *M. granulata* in Western as well as Eastern Ringsjön (in Aug.—Sept. 1896 and 1900). She thinks that it was *M. islandica*. This species was not differentiated until 1906 (Müller 1906). It is not quite impossible, however, that Lemmerman has seen *M. granulata*, as the frequency of this alga proved to be at its highest in September during the years 1947—50, whereas *M. islandica* is very rare at this time. Moreover, it is somewhat more difficult than ordinarily to distinguish the two species in Ringsjön without a careful study, because *M. granulata* mostly lacks the long characteristic end spines (Fig. 3). The var. *angustissima*, which also occurs rather frequently, is always provided with long end spines.

In any case, Lemmerman noted only occasional or rare colonies,

and therefore there is reason for assuming that *M. granulata*, if present, was rather uncommon in Ringsjön at the end of the nineteenth century, that is, immediately after the lowering which took place in 1887 (Trybom 1893). Fifty to sixty years later the plankton samples give another picture. Now it is seldom absent in the summer samples, although it is often fairly occasional. In 1947 its maximum came in July and September—October, in 1948 in July and September, and in 1949 in September. In 1950 there was no pronounced maximum. The maximum in 1947 was very well-marked and of long duration, probably attributable to the dry warm summer. In none of the samples mentioned above does *M. granulata* reach such an abundance as shown by *M. islandica* in several of the winter samples. Figure 4 proves, however, that a similar mass development can occur. (The sample was gathered in the westernmost part of W. Ringsjön.)

As is evident from the facts given above, a marked increase in the development of *M. granulata* can be observed in Ringsjön. An acceptable explanation might be the effect of the great lowering in 1887, which caused a strong change in the natural development of the lake. The increasing pollution of the lake water may possibly also contribute to more favourable conditions for *M. granulata*. Previously the lowering has been suggested as a possible cause of an increased development of charads and a general change of the higher water vegetation (Lundh 1951, p. 27).

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Svensk Botanisk Tidskrift. Bd 48, H. 2. 1954.

OM UTBREDNINGEN I NORDEN AV GRÅKREMLING, ASTEROPHORA PARASITICA (BULL. EX FR.) SING.

AV

S. WOLDMAR.

Föreliggande anteckningar avse förekomsten av gråkremling, *Asterophora parasitica* (Bull. ex Fr.) Sing. [= *Nyctalis parasitica* (Bull. ex Fr.) Fr.] på skandinaviska halvön och i Danmark. Några inledande ord angående släktet *Asterophora* i dess helhet och dess nomenklatur torde dock ej vara ur vägen.

Släktet *Asterophora* uppställdes 1817 av tysken L. P. Fr. Ditmar för *A. lycoperdoides*. Det är dock mera känt under namnet *Nyctalis*, vilket lanserades av Fries 1825 i »Systema orbis vegetabilis» och »Stirpes agri femsionensis» för *N. parasitica*. Genom de förändringar, som på Stockholmskongressen 1950 vidtogos i »International Code of Botanical Nomenclature», kan det emellertid ej råda någon tvekan om att *Asterophora* blir det giltiga släktnamnet. Detta upptogs nämligen ej blott 1821 av den engelske naturforskaren S. F. Gray i dennes »Natural Arrangement of British Plants», vilket arbete numera fått oomstridd nomenklatorisk giltighet, utan även av Fries i tredje delen av »Systema mycologicum». Namnet *Nyctalis* nämnes överhuvud ej i »Systema», och i »Elenchus fungorum» nämnes det visserligen men användes ej (Nannfeldt in litt.). Namnet *Asterophora* måste därför anses ha nomenklatorisk prioritet.

Släktet innehåller blott två säkra arter[1], näml. *A. lycoperdoides* (Bull.) Ditm. ex Gray och *A. parasitica* (Bull. ex Fr.) Sing., båda förekommande hos oss och båda växande parasitiskt och saprofytiskt på ± nedruttnade *Russula*- och *Lactarius*-arter. Dess placering

[1] En av J. A. Weinmann beskriven europeisk art, *Nyctalis nauseosa* Weinm., omnämnes av Fries m. fl. Lange anser den vara identisk med en av honom beskriven, storvuxen form av *Asterophora lycoperdoides* (*Nyctalis asterophora* forma *major*).

Fig. 1. *Asterophora parasitica*. Lamellerna äro tjocka, glesa och ofta nedlöpande. Ung. 3 ggr. Västergötland, V. Tunhem, 4.9. 1953. — Foto Gustaf Carlsson.

i systemet har varit växlande. Fries hänförde ursprungligen *A. parasitica* till »tribus» *Collybia* av *Agaricus*. Konrad & Maublanc (1949) ställa det också alltjämt bland *Collybiae*. Lange (1940) m. fl. ge det en plats bland *Hygrophorae*. De köttiga lamellerna (fig. 1) synas dock knappast vara av *Hygrophorus*-typ. Singer (1951), Kühner & Romagnesi (1953) och Moser (1953) inrangera släktet i *Tricholomataceae*, där det med *Lyophyllum* Karst., som omfattar de traditionella släktena *Collybia*, *Clitocybe* och *Tricholoma*, delar egenheten att ha karminofila basidier.

A. lycoperdoides, stoftkremlingen, är i Norden känd från ett flertal lokaler i såväl löv- som barrskog, och i det övriga Europa är den ej heller ovanlig. Från *A. parasitica*, gråkremlingen, skiljer den sig genom den av klamydosporer brunpudrade, inrullade hatten. Denna är hos gråkremlingen »klocklik—utbredd, blek—(lila)grå, sidenhårig» (Ingelström 1940).

A. parasitica, som huvudsakligen växer på ruttnande trattkremlor (*Russula delica*), är mera sällsynt än *A. lycoperdoides*. Från en jämn

Fig. 2. *Asterophora parasitica* på rutten trattkremla (*Russula delica*). Västergötland, V. Tunhem, 4.9. 1953. — Foto Gustaf Carlsson.

men sparsam förekomst i södra och mellersta Europa avtar den i frekvens mot norr för att i Skandinavien endast förekomma sporadiskt och ej nå utanför ekens nordgräns. I Danmark uppges den vara »sjælden» (Ferdinandsen & Winge 1943), men ett 20-tal lokaler kan dock redovisas därifrån. I Sverige är den känd från 10 och i Norge från 4 lokaler. I Finland synes den ej vara anträffad. Den omnämnes visserligen i Karstens arbeten, men enligt Hagen (1943 p. 116) avses förmodligen *A. lycoperdoides*. I Botaniska institutionens i Helsingfors samlingar saknas finska kollekter av gråkremling, och i brev därifrån meddelas, att den »av allt att döma inte blivit tagen i Finland» (N. Malmström). Med hänsyn till det sätt, varpå den förekommer i de övriga nordiska länderna, kan man dock vänta fynd av den i lövdungar i Egentliga Finlands och Nylands kusttrakter.

En sammanställning av gjorda fynd visar, att gråkremlingen i Skandinavien och Danmark förekommer i lövdungar med ek och/eller bok som dominerande trädslag. Nathorst-Windahl uppger (1945) ek som växande på Marstrandslokalen, och lokalerna i V. Tunhem och på Skaftö äro lövdungar med vildväxande bok och genuin lundvegetation.[1] I Danmark förekommer den uteslutande i lövskog, särskilt i lövskogarna på norra Själland. Även då fynd redovisas från de västjylländska hedområdena (Larsen 1934) avses inom dessa belägna lövdungar (Paabol Plantage, Baastlund Krat).

Gråkremlingens begränsade förekomst är anmärkningsvärd, då trattkremlan, som är dess förnämsta värdsvamp, är »allmän i löv- och barrskog i hela Skandinavien, åtminstone så långt skogen går» (Nannfeldt 1945). Det förefaller därför som om gråkremlingen ej blott vore beroende av lämpligt substrat utan därjämte av andra betingelser, exempelvis av extrema ljusförhållanden och en onormal luftfuktighet. Thessleff (1920) framhåller också dessa faktorer som betydelsefulla för svampparasiter och svampsaprofyter, i det de verka så förändrande och nedbrytande på värdsvamparna, att dessa just härigenom bli lämpliga som substrat. Då gråkremlingen härtill, som ovan nämnts, synes vara bunden till lövskogar och -lundar och samtliga kända lokaler äro belägna inom ekens utbredningsområde, kan man förmoda, att dess förekomst är beroende av sådana ekologiska, edafiska och klimatiska faktorer, som betinga förekomsten av ädlare lövskog. Det är också möjligt, att de i barrskog växande kremlorna till följd av den i dessa skogar speciella markbeskaffenheten äro så olika till struktur och sammansättning, att de ej äro tjänliga till substrat för gråkremling.

Kartor över storsvamparnas utbredningsområde kunna lätt bli missvisande, emedan tillgängligt herbariematerial ofta är otillräckligt och mykofloran därtill kan vara dåligt känd eller helt outforskad inom stora områden (jfr Andersson 1943). Gråkremlingens utbredning kan sålunda inte i detalj avläsas å kartan (fig. 3), men det framgår dock, att de kända fyndorterna ligga inom ekens utbredningsområde och huvudsakligen inom det granskogsfria lövskogsområdet.

Lokalförteckning.

Förkortningar: F = Friesia, Nordisk Mykologisk Tidskrift; K = Kgl. Veterinær- og Landbohøjskolen, Köpenhamn; Meddel = Meddelelser fra

[1] Den strängt lövskogsbundna lömska flugsvampen (*Amanita phalloides*) anträffades av förf. på Skaftölokalen i augusti 1953.

Fig. 3. *Asterophora parasitica* på skandinaviska halvön och i Danmark.

Foreningen til Svampekundskabens Fremme; O = Universitetets Botaniske Museum, Oslo; S = Naturhistoriska Riksmuseet, Stockholm; U = Universitetets Botaniska Museum, Uppsala.

Danmark.

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Bjørnekær anmärker, att svampen här har »været til Stede i samme Terræn i betydeligt Antal i adskillige Aar». (Ibid.) Man fann den även vid exkursion 27.VIII.1950 (F IV p. 226), men 16.IX.1951 sökte man den förgäves (F IV p. 365). — Grib Skov, 21.IX.1930, *Russula nigricans*. Aa. Lund (K). — Bromme Plantage, 28.VIII.1932, *Russula delica*. F. H. Møller (F.H.M. in litt.). — Nørreskov, 4.IX.1932, *Russula nigricans*. N. F. Buchwald (K) (N. F. B. in litt.). — Amager, Kongelunden, 25.VIII.1934. *Russula delica*. H. V. Rævskjær & N. F. Buchwald (N. F. B. in litt.). Även 11.IX. 1949. "Et par Steder paa *Russula nigricans* og *delica*" (F IV p. 127). — Lolland: Maltrup Vænge, 20.IX.1931. F. H. Møller (F I p. 129). Ej angivet på kartan. — Ryde Skov 16.X.1938. F. H. Møller (F. H. M. in litt.). — Rudbjerggaards Skove. — F. H. Møller (Ibid.). — Fyn; Langesø, 26.IX. 1925. (Meddel 1925: 2 p. 107.) — Kirkeby Hedeskov, 3.X.1948, *Russula delica*. F. H. Møller (F. H. M. in litt.). — Jylland: Hald Egeskov, 6.VII. 1905, *Russula* sp. Ove Rostrup (K). — Stenderup Skov, 1.IX.1919. C. H. Ostenfeld (K) (Ibid.). — Aarhus, Marselisborg, 29.VIII.1920, *Russula delica*. (Meddel 1920: 2 p. 107.) — Paabøl Plantage, X.1925, *Russula adusta*. Poul Larsen (1934). — Baastlund Krat, IX.X.1926, *Russula nigricans*, *R. adusta*. Poul Larsen (1934). — Bobæk Skov, 1.X.1944, *Russula delica*. Frede Terkelsen (1945).

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Norge.

Flekkefjord (O). — Borre, Vestfold, 16.IX.1917. J. Egeland (O). — Bergen, 1912. J. E. Thomie (O). — Aker, Sognsvatn, 12.IX.1943. (O)

De norska lokalerna enligt Hagen (1943). Övriga uppgifter ha erhållits genom tillgänglig litteratur och exkursionsredogörelser i Friesia och Meddelelser fra Foreningen til Svampekundskabens Fremme. Dessutom ha värdefulla råd och upplysningar lämnats av enskilda och från ovan nämnda institutioner och museer. Härför framföres ett varmt tack.

Summary.

Asterophora parasitica grows as a parasite on decaying *Russulas*, especially *R. delica* and is not uncommon in Southern and Central Europe. It is also met sparsely in Scandinavia, where it does not grow outside the northern limit of *Quercus*. It seems to be dependent not only on the substrate but also on such factors as are necessary for the occurrence of genuine frondose woods. It may be possible that the character of the soil in coniferous woods may give the *Russulas* so different properties that they are not suitable as a substrate for *A. parasitica*.

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SOME FACTS CONCERNING THE INCOMPATIBILITY GROUPS, THE DICARYOTIZATION AND THE FRUIT BODY PRODUCTION IN COLLYBIA VELUTIPES.

BY

KARIN ASCHAN.

Introduction.

The work of Kniep (1920) and Vandendries (1923) showed quite clearly that *Collybia velutipes* is a heterothallic species. Later both Zattler (1924) and Funke (1924) proved conclusively that here we are concerned with a tetrapolar species. Their results were confirmed by investigations of Newton (1926), Heldmaier (1929) and Brodie (1936).

When the author first started working with *Collybia velutipes* the problem of incompatibility groups and the production of fruit bodies was not the chief point of interest, nor was further attention given to the rather obscure scheme of pairings between monospore cultures from the same fruit body. The clamp formation found in some cases was, however, more in accordance with a dipolar than a tetrapolar scheme. At first, the explanation of this fact was thought to be that too few basidiospore mycelia were isolated and that therefore, by chance, not all the existing incompatibility groups had been obtained. Other modifying genes were also thought to be responsible for this unusual pairing scheme since physiological and morphological mutants derived from compatible wild-type strains have often shown a pairing capacity lower than that of the original strain. By tetraspore isolations direct from a basidium it should, however, be possible to get hold of the seemingly missing incompatibility groups (especially since Funke obtained all 4 mating groups in 3 out of 4 successful tetraspore isolations, thus showing that the reduction might occur in the second division in *Collybia velutipes*).

The results of such isolations were at first somewhat confusing and seemed to indicate a dipolar instead of a tetrapolar form of *Collybia velutipes*. Di- and tetrapolarity are thought to exist in a few species (cf. WHITEHOUSE 1949 p. 218; QUINTANILHA & PINTO-LOPES 1950). However, since the taxonomy of some of these species, e.g. *Corticium coronilla* and the *Coprini*, is unclear, they have been excluded from this discussion. Such taxonomical obscurity does not seem to exist in the following species:

Psilocybe coprophila (dipolar, GILMORE 1926 and BRODIE 1935; tetrapolar, VANDENDRIES 1937 *a* and *b*) and *Radulum orbiculare* (tetrapolar according to LACY in BIGGS 1938; dipolar, FRIES 1941) and perhaps even *Annelaria separata* (tetrapolar, ROUTIEN 1940; dipolar, VANDENDRIES 1923) and *Hypholoma fasciculare* (tetrapolar, FUNKE 1924; dipolar, VANDENDRIES 1924).

Material.

Monospore mycelia from fruit body A (15 mycelia), I (10 mycelia) and L (12 mycelia), as well as some biochemical mutants (10 mycelia), have been studied in this investigation. For more detailed information concerning their origin and the origin of some other strains used in this investigation see ASCHAN 1952 and ASCHAN & NORKRANS 1953. These monospore mycelia were isolated from very dilute spore suspensions germinating in malt agar dishes. This method has been criticised (HANNA 1924) since mixtures of mycelia from two spores might be isolated, and thus mixtures of incompatible strains obtained which could give unusual pairing patterns. Through careful control, monospore mycelia L 1, L 7 and L 11 arising from only one nuclear type were obtained.

Special interest has been given to the incompatibility groups of mycelia from the L-fruit body. The dicaryotic (L 1 × L 7) combination has been used to obtain fruit bodies, the spores of which were directly isolated from the basidia. In particular the twelve monospore mycelia from the three basidia numbers 24, 25 and 48 have been used. The four mycelia isolated from each basidium are always called *a*, *b*, *c* and *d* prefixed with the number of the basidia in question.

Methods.

The clamp-forming tendency between two mycelia can vary from weak to strong. No classification has been made in this inves-

tigation (cf. HELDMAIER 1929, with 5 classes) other than positive or negative results of tests for clamps, regardless of the number of clamps produced. The mycelia analysed for clamps were taken from the border line between two mycelia cultivated on malt agar (2.5 % malt extract; 2 % agar in aqua dest.) at room temperature (about 18° C). Later, mycelia on either side of the contact zone between two mycelia were tested for clamps. (See Photo 1 where the three different test-spots can be seen.) No tests for clamps were made earlier than one week after inoculation and usually they were made during the second week.

Since *Collybia velutipes* produces oidia there is a certain danger of contamination. However, all the results of clamp formation and fruit body production were obtained from at least two pairings.

Fruit bodies were produced on malt agar of the same concentration as above in large culture tubes (3.5 × 22 cm). They were first cultivated for one week at − 25° C in the dark and were then transferred to a light incubator at +10° C or + 15° C. After about 5—6 weeks in the light incubator (usually earlier at + 15° C) fruit bodies or at least good indications of fruit body production could be observed. Tubes in which no fruit body production was evident were left in the light incubator for about two months.

The starting mycelia used in fruit body production experiments were microscopically examined after cultivation on cellophane sheets, according to a method described earlier (ASCHAN 1952 p. 373) in order to check that only dicaryotic hyphae were used.

Tetraspore isolations were performed at room temperature with a FONBRUNE micromanipulatur with glass-needles moistened in nutrient solution. Tetraspore isolations were made from about 10 different gills from fruit bodies of the same dicaryotic pairing.

All the spores from a basidium were transferred to one hanging droplet of sterile water which was then protected from drying by application of sterile paraffin oil according to the micro-culture technique of FONBRUNE. Nutrient solution (max. or min. solution cf. ASCHAN 1952) was then added to the water-droplet with a micropipette. The four spores from one basidium were separated from the common droplet into droplets of their own. If, however, the spores were lying well scattered in the common droplet they were allowed to germinate somewhat before being separated.

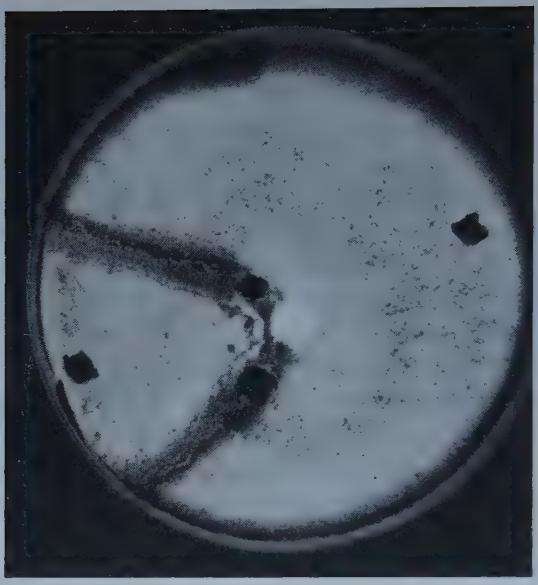


Photo 1. The photo shows where the tests for clamps were made on a pairing between two monospore mycelia. Test spots are taken on the border line between the mycelia as well as on either side of it. This photo is of a mating where clamps were seen only in the line of demarkation.

Photo 2. A tiny undeveloped fruit body from the pairing (24 *c* × 48 *b*), which is an example of pairings that show clamps only in the contact zone and give rise to the type of rudimentary fruit bodies marked "*f*".

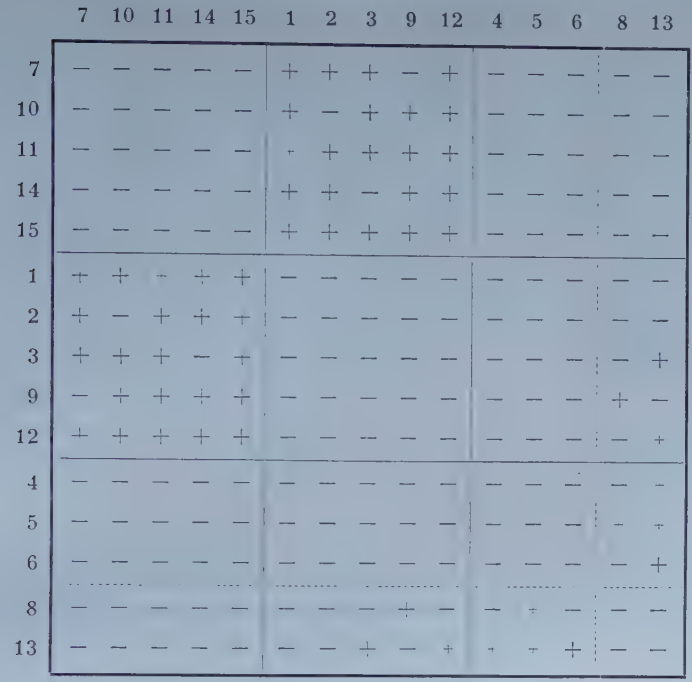


Fig. 1. Pairing pattern of the A-strains obtained from two matings, one in 1948 immediately after isolation of the basidiospores and one 1952. One small + means that clamp-formation was noticed only in 1948.

Results.

The clamp-forming reactions of monospore mycelia from the A, I and L fruit bodies are recorded in Figs. 1, 2 and 3 respectively. It must be stressed that even in cases where only a few clamps could be seen it is a question of real clamps and not pseudo-clamps. A second analysis of the A-strains a few years after isolation showed positive clamp reactions in fewer pairings than in the analysis made immediately after the spores were isolated (Fig. 1). The L-strains were paired three times (October 1949, April 1951, and May 1953). Clamp formation was not evident all three times in some of the matings (Fig. 2). Matings in which clamps were seen all three times are marked with a large plus sign (+); when seen only twice, with two small plus signs ($\overset{+}{-}$); when seen only once, with one small plus sign ($\dot{+}$). Taking into consideration the pairings where clamps were seen at least once, the pairing patterns for the

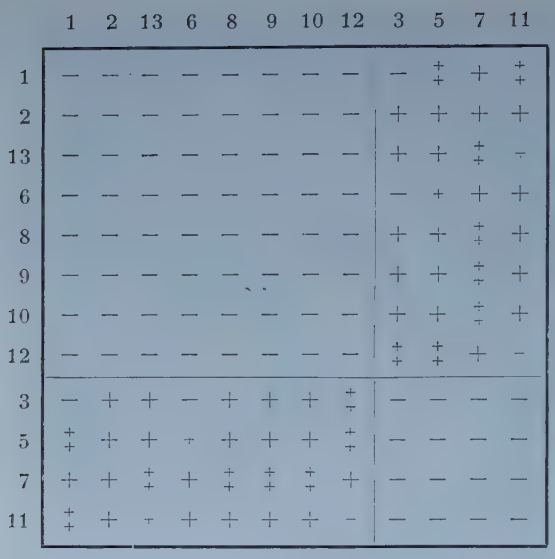


Fig. 2. Pairing pattern of the L-strains obtained from matings in 1949, 1951 and 1953. Appearance of clamps all three years is shown by one large plus, + ; seen only twice with two smal pluses, ‡; and only once with one small plus, +.-In matings (5 × 6) and (11 × 12) clamps were only found 1953.

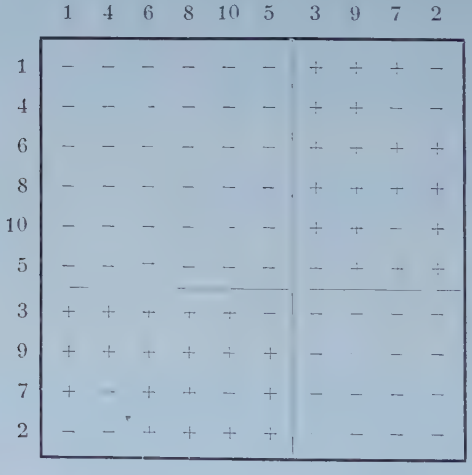


Fig. 3. Mating pattern of I-strains from matings made a few years after isolation of the spores.

I- and L-strains seem to be more in accordance with a dipolar than a tetrapolar scheme.

In this connection it might be of interest to mention that the strains A 3, A 6, A 11 and A 13 as well as L 1, L 3, L 5, L 7 and L 13 were sent to Professor JOHN R. RAPER at the University of Chicago in January 1952. He found that the pattern of mating within the L-series agreed with the results published here except for the occasional reaction (L 1 × L 5) and (L 7 × L 13). As of February 1952 he had not observed any reactions between the four A-strains which had been sent to him as representatives of four different mating types. A possible explanation for the difference in results will be discussed later (p. 617).

As already mentioned in the introduction, basidiospore isolations were performed in order to isolate and define the different mating types.

Many of the attempts at isolating all four spores from one basidium of the dicaryotic fruit body (L 1 × L 7) were unsuccessful, but even when less than four spores were isolated they were controlled after germinating and the mycelia later tested against L 1 and L 7 respectively. All monospore mycelia from the same basidium were also paired in all possible combinations. Of 118 basidiospores isolated directly from basidia only 53 germinated. However, 52 of them were successfully transferred from the micro-culture to the macro-culture. From 25 basidia all four spores were successfully isolated. But only in 4 of these cases did all four spores germinate and one of these mycelia was later lost when transferring it from the micro- to the macro-culture. Contrary to what could be expected for a tetrapolar species all isolated mycelia showed at first rather good clamp formation with either L 1 or L 7, when only the contact zone was examined for clamps. Of all the 52 isolated mycelia, 23 paired with L 7 and the remaining showed clamp formation in matings with L 1.

All the spores from basidia numbers 24, 25 and 48 were kept alive. When the spores from the same basidium were paired, the tests for clamps gave the same results as could be expected from a dipolar type.

Because of the low germination percentage (44.4 %) it was first thought that the two missing incompatibility groups carried lethal factors, but even the F_1 spores from the A-strains gave a germination percentage of about the same order under the same nutritional conditions. The germination percentage of *Collybia velutipes* is known

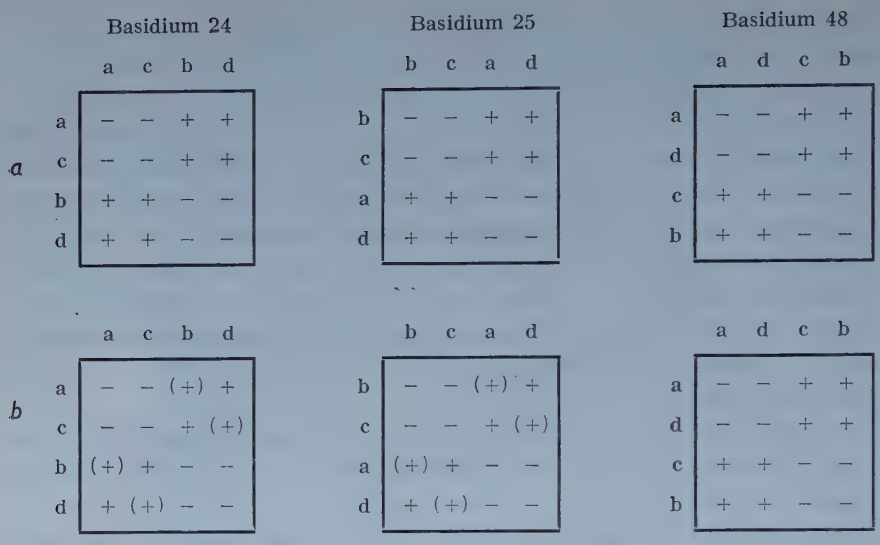


Fig. 4. Three pairing patterns for the four mycelia from basidia numbers 24, 25 and 48, all from one fruit body (L 1 × L 7). *a* shows the results when only the contact zone between two mycelia is examined for clamps. *b* shows the result when dicaryotization is taken into consideration. A plus sign denotes complete dicaryotization on both sides of the contact zone, and a plus sign within parentheses indicates dicaryotization found only in the contact zone.

to be influenced not only by the age of the spores but also by environmental conditions (Vandendries 1923).

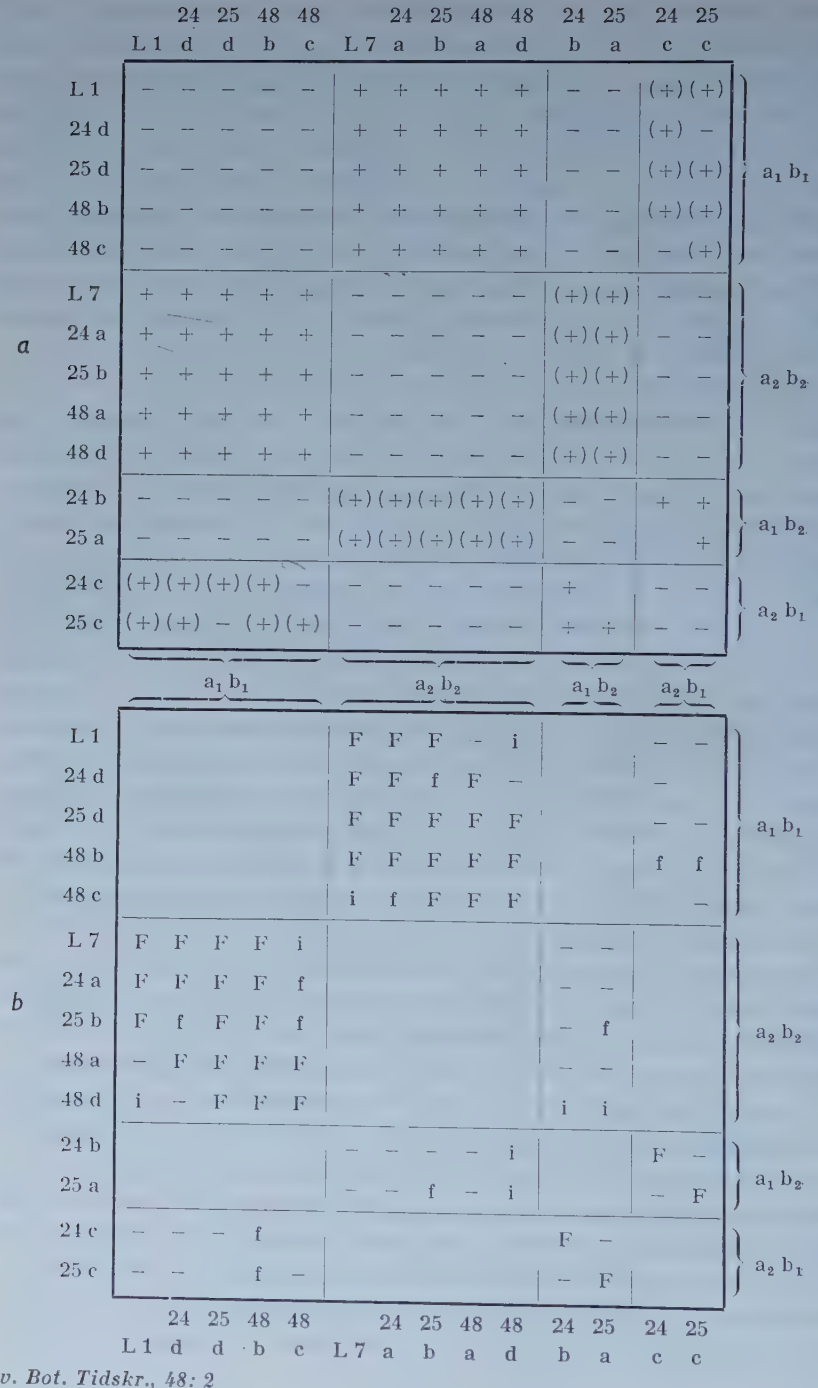
The results obtained later, however, showed clearly that the low percentage of germination had nothing to do with the mating types which at first seemed to be missing.

Interest was aroused in the problem of uni- and bilateral dicaryotization for *Collybia velutipes* because, as in *Polyporus abietinus* a strain (called E_1) with degenerative growth was observed and in *Polyporus abietinus* (Fries & Aschan 1952) a similar degenerative growth was found to be associated with unilateral dicaryotization (earlier used term is diploidization; cf. Buller 1941; Lindegren 1942).

The question arose whether any unilateral dicaryotization might be found between strains in which this type of degeneration could not be noticed and if, perhaps, any correlation might exist between the dicaryotization capacity and the quantity of clamps found in certain matings. When the mycelia on either side of the contact zone were tested for clamps, the matings in which clamp formation had been observed earlier could be put into two categories: (1)

matings with clamps only in the contact zone, and (2) matings with complete dicaryotization. Sometimes only a few clamps were seen in matings of category (1) but in general the clamps were as abundant as in matings with bilateral dicaryotization. In a few pairings the clamp formation at first seemed to be unilateral but after a few days both mycelia were dicaryotized (e.g. $48b \times 48d$ and $48c \times 48d$). More exact data concerning the time required för complete dicaryotization cannot be given since environmental conditions were not standardised and the pairings were not analysed at regular intervals. This is not the case for the results shown in Table I (p. 615) where both conditions and test intervals were standardised. The pairing patterns for the three different basidia 24, 25 and 48 are shown in Fig. 4. Fig. 4 *a* shows the results when only the contact zone was examined for clamps, and Fig. 4*b* the results when the whole area, including the contact zone, was examined. The latter pairing pattern is of a tetrapolar type. A small plus sign in parenthesis (+) means that clamps were only found in the contact zone. The results are thus in accordance with the tetraspore isolations made by FUNKE in which he found that two as well as four mating types could be found in different tetraspore isolations from *Collybia velutipes*, but he says nothing about such a low germination percentage as was found for spores in this L-mating (cf. what has earlier been mentioned concerning germination per cent, p. 609). Fig. 5*a* shows the results obtained when these same 12 mycelia were paired in every possible combination as well as with L 1 and L 7. The results thus show that here we have four mating types. The genetic constitution of each is marked in the figure in the usual manner depending on different alleles at two unlinked loci (a_1b_1; a_2b_2; a_1b_2; a_2b_1).

All pairings where hyphae with clamps had been observed were tested for their capacity to produce fruit bodies regardless of whether the matings showed incomplete or total dicaryotization. In order to be sure that none of the original monocaryotic hyphae was among the clamp-forming hyphae tested for fruit body production the mycelia were as mentioned p. 605 all controlled microscopically on cellophane sheets. The results are recorded in Fig. 5*b*. Matings giving rise to well-developed fruit bodies are marked "F", fruit bodies with undeveloped pilei but with more or less perfectly developed stipes are marked "f", and fruit body rudiments are marked "i". One type of half-developed fruit body can be seen in Photo 2. This undeveloped fruit body of "f" type is derived from the mating


a
b
L 1 24 d 25 d 48 b 48 c L 7 24 a 25 b 48 a 48 d 24 b 25 a 24 c 25 c
24 25 48 48 24 25 24 25
a1 b1
a2 b2
a1 b2
a2 b1

(24*c* × 48*b*). If the results shown in Fig. 5*b* are compared with those in Fig. 5*a* it can be seen that only well-developed fruit bodies have been found in matings with complete dicaryotization. This occurs when the two pairs of genes which most influence the dicaryotization process are different in both the "A" and "B" loci. If the alleles at the "B" loci are identical but not those at the "A" loci, clamps are formed only at the contact zone and these hyphae give only rise to primordia or half-developed fruit bodies under the culture conditions used. Under the same conditions usually the monospore mycelia showed no production of primordia or rudimentary fruit bodies but in L 7 and 48*b* rudiments have been noticed in some control tubes. A negative sign in Fig. 5*b* shows which pairings were not stable enough to remain in the dicaryotic state. The dedicaryotization process in these pairings started very early when cultivated on the cellophane (cf. p. 605). Now and then a test tube with dicaryotic mycelium from a mating which usually produced perfect fruit bodies failed to give them. On repeating the tests, however, perfectly developed fruit bodies were obtained. The reason for this variation is unknown. In one of the incompletely dicaryotized matings (24*a* × 24*b*) a well-developed fruit body was obtained once. No other fruit body or primordium was seen in the control tube or in repeated tests. Therefore these results are omitted from the scheme in Fig. 5*b*, where the results are based on at least two cultures exhibiting similar behaviour. It is impossible to state whether these deviations are due to contamination or mutation.

When the I-strain mycelia (Fig. 6) were tested for complete or incomplete dicaryotization the results obtained were quite similar to those obtained from the L-strains. Thus even here it is a question of four mating types which exhibit a very strong tendency for "illegitimate" pairings when one of the alleles for incompatibility is present in duplicate, and therefore the tetrapolarity might be hidden if tests for clamps are made only in the contact zone between two mycelia. (Compare Fig. 6 with Fig. 3.)

As was already mentioned in the Introduction, pairings between mutants often showed a lowered capacity to form clamps. Some of

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Fig. 5. Clamp formation (*a*) and fruit body production (*b*) from all possible matings between the monospore mycelia from basidia 24, 25 and 48, from fruit body (L 1 × L 7), and the original L 1 and L 7 strains. + denotes complete dicaryotization, (+) only border line dicaryotization; *F*, perfectly developed fruit bodies; *f*, half-developed, more or less rudimentary fruit bodies with stipes and undeveloped pilei; *i*, only tiny fruit body rudiments were observed.

	1	4	6	8	10	5	3	9	7	2
1	–	–	–	–	–	–	+	+	(+)	–
4	–	–	–	–	–	–	+	+	–	–
6	–	–	–	–	–	–	+	+	(+)	(+)
8	–	–	–	–	–	–	+	+	(+)	(+)
10	–	–	–	–	–	–	+	+	–	(+)
5	–	–	–	–	–	–	–	(+)	+	+
3	+	+	+	+	+	–	–	–	–	–
9	+	+	+	+	+	(+)	–	–	–	–
7	(+)	–	(+)	(+)	–	+	–	–	–	–
2	–	–	(+)	(+)	(+)	+	–	–	–	–

Fig. 6. Mating pattern as well as dicaryotization in the I-series; + denotes matings with total dicaryotization and (+) matings where clamps were seen only in the contact zone.

these dicaryotic matings with one or both nuclei of the mutant type were very difficult to isolate in a stable dicaryotic state. In some cases, only through repeated isolation of mycelia taken from the contact zone between the two paired mycelia was it possible to isolate a stable dicaryotic mycelium. It therefore seemed to be of special interest to investigate more closely the dicaryotizing capacities of pairings between biochemical mutants from which stable dicaryotic mycelia had previously been obtained. In this investigation most of the biochemical mutants showed a lower dicaryotization capacity than the original wild-type strains L 1 and L 7, from which most of the mutants derived. The mycelia were examined for clamps 10 and 18 days after being paired. The results are recorded in Table I. The wild-type strain from which each mutant has been derived is given in parentheses after the specification of the biochemical character of the mutant in question. The plus and minus signs denote, in the usual way, the presence and the absence, respectively, of clamps. The sign in the middle refers to clamps found in the contact zone and the other two to clamps found on either side of this zone. The first sign always refers to the mycelium mentioned first in the pairing, and the third sign to that mentioned last. The dicaryotization capacities of L 3 and L 10, which degenerated strongly in the autumn of 1953, are also recorded in this table. It is thus shown that many matings which were incompletely dicaryotized after 10

Table I. The dicaryotization results for different strains, from pairings in which stable heterocaryons had earlier been obtained.

All tests were made at the same time and under the same culture conditions. The original wild-type from which each mutant has been derived is given in parenthesis. Deg. = degenerated, vit. = vital, − + − denotes incomplete, and − + + or + + − unilateral dicaryotization. The first sign refers to dicaryotization of the strains in a pairing mentioned first and the third to the strain mentioned last. The sign ± means that the degenerated mycelium has grown so slowly that it is nearly overgrown by the more vital one and because of this it is almost impossible to decide whether the degenerated mycelia are dicaryotized or not.

Heterocaryotic combination	Type of mycelia paired	Dicaryotization after 10 days	Dicaryotization after 18 days
F 34/107 × L 7	methionineless (L 1) × wild-type L 7	− + −	+ + −
F 31/170 deg. × L 7	adenineless, deg. (L 1) × ,, L 7	− + −	− + +
F 31/170 vit. × L 7	,, vit. (L 1) × ,, L 7	− + −	+ + +
F 31/40 × L 7	isoleucin-valinless (L 1) × ,, L 7	− + +	+ + +
F 29/157 × L 7	argininеless (L 1) × ,, L 7	± + +	+ + +
L 1 × F 36/198	wild-type (L 1) × uridineless (L 7)	− + −	+ + +
L 1 × F 36/257	,, (L 1) × ,, (L 7)	− + +	+ + +
F 29/157 × F 28/42	arginineless (L 1) × arginineless (L 11)	− − −	− − −
F 29/157 × F 36/198	,, (L 1) × uridineless (L 7)	− + −	− + +
F 29/157 × F 36/257	,, (L 1) × ,, (L 7)	+ + +	+ + +
F 31/170 vit. × F 36/257	adenineless, vit. (L 1) × ,, (L 7)	− + +	− + +
F 31/170 deg. × F 36/257	,, deg. (L 1) × ,, (L 7)	− + +	± + +
F 34/110 × F 36/257	cytidineless (L 1) × ,, (L 7)	+ + +	+ + +
F 34/110 × F 36/198	,, (L 1) × ,, (L 7)	+ + −	+ + +
F 8/86 × L 1	methionineless (D) × wild-type L 1	− + −	− + +
F 8/86 × L 7	,, (D) × ,, L 7	− + −	− + +
F 8/86 × L 11	,, (D) × ,, L 11	− + −	− + +
F 8/86 × F 29/157	methionineless (D) × arginineless (L 1)	− − −	− −
F 8/86 × F 28/42	,, (D) × ,, (L 11)	− − ·	− − −
F 8/86 × F 38/46	,, (D) × methionineless (L 1)	− · ·	− + +
F 8/86 × F 36/257	,, (D) × uridineless (L 7)	− + +	· + +
F 8/86 × F 34/107	,, (D) × methionineless (L 1)	− − −	− − −
L 3 deg. × L 4	wild-type, deg. L 3 × wild-type L 4	− + +	− + +
L 3 deg. × L 8	,, ,, L 3 × ,, L 8	− + +	− + +
L 10 deg. × L 11	,, ,, L 10 × ,, L 11	− + −	− + +
E 1 deg. × O 24	,, ,, E 1 × ,, O 24	− + +	− + +

days were completely or unilaterally dicaryotized after 18 days. In most pairings with the methionineless F 8/86 no clamps could be found even after 18 days. These are pairings of the above-mentioned type which only rarely give rise to stabilised dicaryotic mycelia in the contact zone. It seems that complete and rapid dicaryotization of the same type as between the normal L 1 and L 7 strains only occurs in pairings in which the cytidineless F 34/110 is involved.

It is interesting to note that the cytidineless F 34/110 once gave rise to a haploid fruit body. F_1 monospore mycelia from pairings with this mutant give rise to monocaryotic mycelia some of which have the ability to form fruit bodies from the haploid mycelia regardless of whether or not they have the biochemical mutant character. Under the same culture conditions the monocaryotic F_1-mycelia from the (L 1 × L 7)-combination have never shown any fruit body production other than rudimentary.

Discussion.

Considering the facts from an evolutionary viewpoint, it is interesting to note that, judging from the literature (cf. p. 604), there seem to exist species in which di- as well as tetrapolar strains are present. The slight suspicion that *Collybia velutipes* might be one of these few cases proved, however, to be false for the strains investigated here. At first a seemingly nearly dipolar scheme was found for the I- and L-mycelia when only the contact zone between two mycelia was examined for clamps. A clear tetrapolar scheme was, however, obtained when tests for clamps were made on either side of the contact zone. Thus, when the "B"-factors are identical, "illegitimate" pairings might occur in *Collybia velutipes* as reported for many other species (Brunswik 1924; Kniep 1928; Quintanilha 1935; Vandendries 1937*b*; a concentrated survey of these and similar facts can be found in Hartmann 1943, p. 83). Most of the clamps in an "illegitimate" pairing seem to be of the pseudo-clamp type. This is not the case in *Collybia velutipes* where the clamps found in these pairings were completely developed. Oort (1930) has seen clamps in *Schizophyllum commune* irrespective of whether it was the "A" or the "B" factors which were identical. He believes that a thorough examination may reveal clamps now and then in every mating, which is not in accordance with the results of Quintanilha and Brunswik working with the same species. Quintanilha (1935) has investigated cyto-

logically the differences between real and false clamps, a difference which sometimes might be difficult to see. He observed pseudo-clamps in legitimate pairings and well-developed clamps in "illegitimate" pairings (Quintanilha 1933). The well-developed clamps found in the "illegitimate" pairings of *Collybia velutipes* are thus in accordance with previous observations made, though not as consistently, in other tetrapolar species.

Dicaryotization in the contact zone has been reported in other species by Vandendries (1933), Smith & Brodie (1935) and Arnold (1935). The latter has observed this phenomenon in species of *Collybia* other than *Collybia velutipes*, and she used the term "limited diploidization" for the phenomenon. Dicaryotic mycelia then grew out fan-wise from the contact zone. Brodie (1948) does not think that the term diploidization is applicable to the above-mentioned cases where diploidization occurs in the contact zone only. The present author, however, prefers to continue to call this phenomenon in *Collybia velutipes* an incomplete or limited dicaryotization, at least until the phenomenon has been more thorougly investigated.

As in *Schizophyllum commune* even old mycelia of *Collybia velutipes* sometimes showed a less marked clamp-forming capacity. Heldmaier (1929) showed that variations in temperature and certain chemicals had some modificative influence on this capacity but the effect was less marked on the *Collybia velutipes* strain investigated than on the *Schizophyllum commune*. Therefore, one cannot exclude the fact that the different pairing reactions obtained in different years or in different laboratories (cf. p. 609) might depend to some extent on such modificative changes.

The occurrence of di- and tetrapolar strains within the same species (cf. p. 604) can, however, hardly be due to modifications depending on different culture conditions. This investigation shows that a strain easily can be mistaken for dipolar if clamps are looked for only in the contact zone between the mycelia. When the process of dicaryotization was taken into consideration the tetrapolarity was, however, unmasked. That the production of clamps can be very different in different parts of a test tube has been noticed earlier by Heldmaier and Vandendries. It is impossible to decide from literature studies if the cases where di- and tetrapolarity have been noticed within the same species might not depend on a similar type of hidden tetrapolarity as in the above-mentioned *Collybia velutipes* strains. The results of Oddoux (1953) also give rise to the question

of whether many dipolar schemes are based on examination of too few monospore mycelia. He got a dipolar pairing pattern from the first 10 isolated monospore mycelia from a *Collybia velutipes* fruit body, but with 20 isolated mycelia he got a tetrapolar scheme with only a few deviations. It would be interesting to know if these deviations could be correlated with some differences in the dicaryotization capacity.

It is, therfore, perhaps still questionable if both di- and tetrapolaraity really exist within all the species mentioned on p. 604. If they do exist trials to cross these stocks ought to be made. An analysis of the F_1 from such a crossing might give some information concerning the different influence of the "A" and "B" loci. Perhaps *Psilocybe coprophila* might be well suited for such an investigation since the dipolarity of this strain is quite clear, based as it is on the mating pattern derived from 30 monospore mycelia (Brodie 1935). Since tetrapolar forms have probably arisen from dipolar types it might be possible to find both extremes within one species as well as intermediate strains with a more or less strong tendency for "illegitimate" pairings. *Collybia velutipes* could thus be looked upon as an example where only one of the extremes (the tetrapolar one) and the different intermediate strains (i.e., I and L) occur.

Once again it is interesting to examine the results of Zattler (1924) who surely has used a similar technique when investigating the mycelia from four different fruit bodies of *Collybia velutipes*. Two of these fruit bodies were taken from the same tree. One of them showed a clear tetrapolar pairing pattern. The other, however, gave a more complicated pairing pattern (cf. Zattler p. 474), which was abandoned since it did not fit into either a di- or a tetrapolar scheme. Zattler probably believed that these deviations could be explained through mutations, as for *Aleurodiscus* (Kniep 1923), or perhaps as a mixture of two different incompatible mating types. If, however, the pairing pattern of this fruit body is arranged as in Fig. 7, its close aggreement with a dipolar scheme is rather striking and similar to the pairing pattern of the L- and I- strains first obtained (Figs. 2 and 3).

Clamp formation is thus, because of the existence of sometimes nearly regularly occurring "illegitimate" pairings, not a good criterion for classifying strains in their respective mating groups, a fact earlier stressed by Oort and corroborated also by this investigation. A better grouping may, however, be obtained by considering the

	4	8	9	11	14	16	1	5	12	10	13	6	7	15	2	3
4	−	−	−	−	−	−	−	−	−	+	+	+	+	+	+	+
8	−	−	−	−	−	−	+	+	−	−	−	+	+	+	+	+
9	−	−	−	−	−	−	+	+	+	+	+	−	+	+	+	+
11	−	−	−	−	−	−	+	+	+	+	+	−	+	+	+	+
14	−	−	−	−	−	−	+	+	+	+	+	−	−	+	+	+
16	−	−	−	−	−	−	+	+	+	+	+	+	+	−	+	+
1	−	+	+	+	+	+	−	−	−	−	−	−	−	−	−	−
5	−	+	+	+	+	+	−	−	−	−	−	−	−	−	−	−
12	−	−	+	−	−	−	−	−	−	−	−	−	−	−	−	−
10	+	−	+	+	+	+	−	−	−	−	−	−	−	−	−	−
13	+	−	+	+	+	+	−	−	−	−	−	−	−	−	−	−
6	+	+	−	−	−	+	−	−	−	−	−	−	−	−	−	−
7	+	+	+	+	−	+	−	−	−	−	−	−	−	−	−	−
15	+	+	+	+	+	−	−	−	−	−	−	−	−	−	−	−
2	+	+	+	+	+	+	−	−	−	−	−	−	−	−	−	−
3	+	+	+	+	+	+	−	−	−	−	−	−	−	−	−	−

Fig. 7. A somewhat different arrangement of an exceptional pairing pattern obtained by Zattler (1924 p. 474).

process of dicaryotization. Knowledge about the production of fruit bodies might point in the same direction as the results of dicaryotization but cannot alone solve the problem of determining mating groups.

Concerning the problem of dicaryotization, it can be said that this is surely not always as simple as for the L- and I- strains. Even among them there existed, as found for the mycelia from basidium 48, a certain indication of delay in the dicaryotization of one of the mycelia. The complexity of the dicaryotization process is, however, clearly demonstrated by slower or sometimes even unilateral dicaryotization of some biochemical mutants and degenerated strains. Modifying genes probably exhibit a great influence on the capacity for dicaryotization. Unilateral dicaryotization has been reported for *Cyathus stercoreus* (Brodie 1948) which was later investigated cytologically (Fulton 1950). Unilateral dicaryotization has been observed between a degenerated, or mutant, type and a normal type from other species, e.g. *Polyporus abietinus* (Fries & Aschan) and *Coprinus fimetarius*

(the so-called "nain" type; QUINTANILHA 1938). In these species, as well as in *Collybia velutipes*, it seems to be the normal type which is dicaryotized by the degenerated strain. The work of FULTON indicates that the two different loci for incompatibility ("A" and "B") influence different phases of the dicaryotization process. One of them seems to exert the greatest influence upon nuclear migration and the other on the formation of dicaryons, but she also believes that other factors are involved. PAPAZIAN (1949, 1950) has shown that other factors actually are involved in *Schizophyllum commune*, the gene "streak" interfering with nuclear migration is linked with one of the genes for incompatibility. This "A" gene (PAPAZIAN 1951) behaves physiologically as one gene but has been shown to be two strongly linked genes. Both PAPAZIAN and FULTON have also studied the dicaryotization cytologically in relation to the different lines of demarkation in certain matings, and PAPAZIAN gives a survey of similar facts critically examining to what degree they might be mutually confirmatory. However, it has not been possible to classify the different types of demarkation lines in *Collybia velutipes* due to the fact that the genes at the "A" — and/or "B" — loci are identical.

Because of the existence of haploid fruit bodies the production of fruit bodies is not valid as a criterion of different mating groups, as was already shown by KNIEP (1920). He refers to the work of WAKEFIELD (1909) who seems to have been the first to notice the production of fruit bodies on monocaryotic mycelia. To quote KNIEP: "... ganz normal gestaltete Fruchtkörper mit ausschliesslich haploiden Zellen entstehen. Das ist ein Beweis dafür, dass die Fruchtkörperbildung nicht notwendig an die Paarkernphase gebunden ist, und dass die Fruchtkörpergestaltung unabhängig von der Kern- und Chromosomenzahl in den Zellen ist." *Collybia velutipes* is a species well known for its production of haploid fruit bodies on certain mycelia (ZATTLER 1924). ZATTLER has shown that the capacity for producing haploid fruit bodies has a genetic basis and, at least in one case, this character segregated as depending on one Mendelian pair of genes. GILMORE (1926) investigated an abnormal production of fruit bodies in *Psilocybe coprophila* which was inherited from one generation to the next but not as a simple Mendelian character. Thus, many factors are involved in the production of fruit bodies which are not identical with the two pairs of genes influencing the mating types. The normal L 1 and L 7 strains and the F_1-mycelia

from matings between them do not seem to have the genetic make up for producing fruit bodies from the monocaryotic mycelia under the culture conditions used. The fruit body production found in the above-mentioned cytidineless strain (cf. p. 616), as well as in F_1-mycelia from combinations with it, indicates the modifying influence of other genes on the production of fruit bodies and on dicaryotization.

Another interesting question is whether the mycelia from "illegitimate" pairings which produce partially developed fruit bodies, could not, under altered conditions, produce perfectly developed fruit bodies. QUINTANILHA (1935) has in *Schizophyllum* even got fruit bodies from "illegitimate" pairings, but after a longer period. The present author has been occupied with studying the influence of different culture conditions on the production of fruit bodies from normal, completely dicaryotized pairings, hoping later to be able to investigate this influence on incompletely dicaryotized wild-type parirings and pairings in which mutants are involved.

Summary.

1. Monospore mycelia from two fruit bodies of *Collybia velutipes* gave a seemingly dipolar pairing pattern when only the border line between two mycelia was examined for clamps. When the mycelia on either side of the contact zone were tested for clamps the clamp-forming matings could, however, be put into two groups — one with clamps only in the contact zone, and the other with clamps on either side of it as well. Clamps are found only in the contact zone when the "B" factors but not the "A" factors are identical. Thus, if the dicaryotization capacity (of which clamps are taken as one criterion) was examined, a tetrapolar pairing pattern was also obtained for these fruit bodies.

2. All matings where clamps were seen (regardless of whether seen only in the contact zone or also on both sides of it) have been investigated for producing fruit bodies under the same culture conditions. Well-developed fruit bodies were obtained only in matings showing complete dicaryotization but were not found in all of these matings. However, only in some of the matings, in which only the contact zone was dicaryotized, could rudimentary fruit bodies with undeveloped pilei be seen, and in most of these pairings no primordium at all appeared. Under the same culture conditions the original

monocaryotic mycelia never gave rise to any fruit bodies but sometimes to primordia and rudimentary fruit bodies.

3. Dicaryotization between a few biochemical mutants has been investigated. All these mutants, as well as degenerated wild-type strains, seem to have a dicaryotization capacity lower than that of the original wild-type strains from which they have arisen, perhaps with the exception of one cytidineless mutant (Table I).

4. The occurrence of tetrapolar mating series showing a strong tendency for "illegitimate" pairings, i.e. with real clamps formed only in the contact zone when the "B"-factors are identical, has been discussed from an evolutionary point of view and in connection with the problem of di- and tetrapolar complexes existing within the same species.

Added in proof.

While this paper was in press the paper on "Heterocaryotic mutagenesis in hymenomycetes" by J. R. Raper & J. P. San Antonio in Amer. J. Bot., 1954, Vol. 41, became available to the author and thereby also two older papers dealing with this problem (J. R. Raper "Tetrapolar sexuality", Quart. Rev. Biol., 1953, Vol. 28, and an abstract by both authors in Records Genetics Soc. Amer., 1952). They have observed that many mutants in *Schizophyllum commune* are like mutants in *Collybia velutipes* "unilateral heterocaryotizers" and that it was the mutant which in such cases failed to accept the dicaryotizing nuclei. Nothing can be definitely stated concerning the existence of "heterocaryotic mutagenesis" in *Collybia velutipes* as reported by them for *Schizophyllum commune* in "common-A heterocaryons". It has to be kept in mind that such an "auto-mutagenic" process, if existing, might influence even the incompatibility groups. The "het-mutants" of *Schizophyllum* may have much in common with the variable neohaplonts found for some pairings of *Collybia* (Aschan 1952). In the latter case it cannot be stated with certainty, however, that it was the question of a "common-A heterocaryon", but the possibility of an altered mutation frequency was discussed.

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I should like to express my gratitude to Dr. Pierre Fonbrune for having personally helped me to learn the technique of his micro-forge and micro-manipulator, thus facilitating this work and making the investigation of 1952 possible. The author also wishes to express her most sincere thanks and deepest gratitude to Professor Elias Melin and Docent Nils Fries for invaluable discussion and criticism.

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SMÄRRE UPPSATSER OCH MEDDELANDEN.

Föreningens medlemmar uppmanas att till denna avdelning insända meddelanden om märkliga växtfynd o. d.

Sparganium fluitans — glomeratum — affine.

En segsliten nomenklaturfråga.

Släktet *Sparganium* representeras i Sveriges flora av 7 arter, förutom varieteter och hybrider. De äro 1. *S. minimum* (Hn) Fr., Bot. Not. 1849; 2. *S. hyperboreum* Læst., Öfv. Vet.-Akad. Förh. IX (1853); 3. *S. Friesii* Beurl., Bot. Not. 1854 (= *S. natans* Fr. m. fl.); 4. *S. affine* Schnitzl., Typhac. 1845; 5. *S. simplex* Huds., Fl. angl. 1778; 6. *S. glomeratum* Læst., Öfv. Vet.-Akad. Förh. IX (1853) [= *S. fluitans* Fr. (1819), 1849 och många senare förf.]; 7. *S. ramosum* Huds. 1778.

Sparganium glomeratum Læst. — Det äldsta exemplar, som föreligger av denna växt under detta namn, finnes i Lunds botaniska museum. Det är från Ångermanland, och på etiketten står med Læstadii stil: »Hernösand 1843. *Sparg. fluitans* Fr. är en annan form, som också finnes i Ångermanland; men Prof. Fries hänför även *Sparg. glomeratum* till sin *fluitans*.» I tryck finna vi arten för första gången upptagen under namn av *Sp. glomeratum* Læst. in schaed. i en översikt av Beurling i Öfv. Vet.-Akad. Förh. för 1852 (tryckt 1853), s. 192. Som namnet anger, karakteriseras den i främsta rummet av sina gyttrade blom- resp. frukthuvud. I vår floristiska litteratur har detta namn slagit igenom först med Neuman (1889).

Sparganium fluitans Fr. — I stället har Læstadii växt under omkring ett halvt århundrade fått gå under det dåligt passande namnet *S. fluitans*. Vanligast förekommer den i mossdiken och ± långsamt flytande skogsbäckar. De många gånger jag påträffat denna art i naturen har jag aldrig observerat några till den hörande flytblad. Att sådana dock kan utbildas har jag emellertid sett på exemplar i våra herbarier (Lund och Uppsala). Datering saknas, men de äro samlade i Odensjö av Fr. Rydeman.[1] På exemplar i Fries, Herbarium Normale, fasc. XV, daterad 1853—57, upplyses om bladen: »non natans, sed tantum in aquis fluitantibus fluitans». Då jag emellertid aldrig sett växten förekomma i rinnande vatten med nämnvärd hastighet, måste flytblad vara mycket sällsynta.

[1] Frans Rydeman, f. 1832. Dennes moder, f. Wieslander, dotter till kyrkoherde W. i Odensjö, var syster till Elias Fries' maka Christina W.

Det är därför naturligt, att jag — och väl flera med mig — kommit att undra över hur detta misspassande namn kommit att åsättas denna art. Föreliggande lilla uppsats är ett försök att utreda denna fråga. Härför har jag — förutom nedan citerad litteratur — till mitt förfogande haft i våra offentliga museer befintligt *Sparganium*-material, där arken äro försedda med av Elias Fries egenhändigt skrivna etiketter, nämligen från Uppsala (U) 9 stycken och från Lund (L) 6 st. I Riksmuseet saknas däremot dylika Elias Fries-ark. I det tillgängliga materialet finnes emellertid två ark med blandat innehåll. Det ena ligger i U, är etiketterat *Sp. simplex*, Femsjö, utan datum; av de tre individ, som finnas på arket är två *simplex* och ett *affine*. Det andra ligger i L. Etiketten lyder: »*Sparganium simplex* var. *subnatans*, Smol., Femsjö. Perperam *affine* dictum.» På arket finnes två individ av *Sp. glomeratum* och ett av *Sp. affine*. Etiketten är — som vanligt hos Fries — odaterad, men därav att namnet *affine* finnes på den kan vi sluta oss till att den ej kunnat skrivas tidigare än 1845, då detta namn först kom till. Hur sammanförandet av de olika arterna kommit till stånd är ju omöjligt att säga. Det är ingalunda säkert, icke ens troligt, att det gjorts av Fries, utan det är mycket möjligt, att växterna legat lösa i hans ursprungliga herbarium, att uppklistringen på museiarken skett av någon annan och att därvid sammanblandning ägt rum.

Första gången vi i svensk floristisk litteratur påträffar namnet *fluitans* i samband med släktet *Sparganium* är i Fries' Flora Hallandica, s. 139. Det uppställes här som β under *Sp. simplex*. Diagnosen lyder: »β pusillum, foliis decumbentibus natantibus, sequentis[1] multo latioribus & brevioribus, basi 3-quetris.» — Nästa gång är i samme författares Stirpium Agri Femsionensis Index, s. 23, där det om denna form står: »In limosis silvarum frequens. Vulgo ad S. *natans* rejicitur ob folia primo decumbentia natantia, sed ubi aqua exciccata omnino in *Sparganium simplex* abit.»

Vi böra här lägga märke till att på intetdera av dessa ställen talas något om fruktställningarnas hopgyttring, som är så karakteristisk för *Sp. glomeratum*, och som gör den till en av släktets lättast identifierbara arter. Det är därför föga sannolikt att Fries när han uppställde sin β *fluitans* skulle haft denna för ögonen. I stället få vi tänka på ståndortsformer av *Sp. simplex*, ävensom på den i dessa trakter ej ovanliga *Sp. affine*, vilken ibland kan bli förvillande lik *Sp. simplex* (Neuman 1889, s. 110). Då heller ingendera av de i Halland och västra Småland ingalunda ovanliga *Sp. minimum* och *Sp. glomeratum* finnes upptagen i något av de båda ovan citerade arbetena, måste vi räkna med att även dessa realiter kan ha ingått i Fries' ursprungliga *Sp. simplex* β *fluitans* och att detta namn sålunda i hög grad är ett nomen ambiguum. I varje fall har det icke uteslutande eller ens i främsta rummet avsett *Sparganium glomeratum*. Fries har vid den tid, varom här är fråga, med andra ord ej klart urskilt de 4 nämnda *Sparganium*-arterna, utan mer eller mindre förblandat dem.

Som vi nedan skall finna kommer Fries långt senare (1849) att ånyo lancera namnet *fluitans* för en *Sparganium*, men då som art och med helt

[1] Bör sannolikt vara sequenti.

annan innebörd än vad först var fallet. Dessförinnan skall vi emellertid något uppehålla oss vid namnet *Sparganium affine*.

Sparganium affine. — Under detta namn hade en utländsk botanist, SCHNITZLEIN, beskrivit en med flytblad försedd *Sparganium* från Vogesernas bergsjöar (Die natürliche Pflanzenfamilie der Typhaceen, Noerdl. 1845, s. 27; den finns ock avbildad i REICHENBACHS Icones Monogr., t. 417). Senare har man funnit, att det är samma art som den nordamerikanska *Sp. angustifolium*, uppställd redan 1803 av MICHAUX. I Sverige har den emellertid hittills gått under SCHNITZLEINS namn.

I sin Summa Veg. II (1849), s. 560, ävensom i Botaniska Notiser för samma år, s. 15, yttrar sig FRIES om den nya växten. På det förstnämnda stället placerar han den under *Sp. natans* och säger blott: »Videtur hujus forma macrior, simplicior, locis vadosis obvia.» — På det senare stället skriver han att denna SCHNITZLEINS nya art är »endast en förkrympt form af vår *Sp. natans*, och att förf., då han urskiljde den, haft *Sp. minimum* under ögonen, i stället för den verkliga *Sp. natans*».

Tre år senare tar ELIAS FRIES' son TH. M. FRIES upp frågan på nytt i Botaniska Notiser 1852, s. 92. Han nybeskriver där en »*Sparganium natans* L., var.». I en not säger han om denna: »Är måhända *Sp. affine* SCHNITZLEIN, men afviker dock i åtskilligt; mogna frukter saknas dock på denna plansch (SCHNITZLEINS), hvadan jag ej kan säkert afgöra saken.»

Samma år har L. M. LARSSON (1852, s. 28) vid Långbanshyttan i Värmlands Bergslag påträffat en *Sparganium*, som han identifierar med TH. M. FRIES' *Sp. natans* L., var. Och i sin flora 1859 har han upptagit den som art under namn av *Sp. affine* SCHNITZL. med ett tiotal värmländska fyndorter angivna.

Första gången vi i den svenska botaniska litteraturen finner den upptagen som en självständig art är emellertid hos en annan av ELIAS FRIES' lärjungar, N. J. SCHEUTZ (1857, s. 50). Som enda kända växtort i sin flora anger SCHEUTZ Femsjö: Knallhult, samma lokal där TH. M. FRIES studerat växten.

ELIAS FRIES själv följer — om ock tveksamt — med. I sitt Herbarium Normale, fasc. XIV: 78, 1849—52, utdelar han exemplar från Femsjö, samlade av TH. M. FRIES, under namn av *Sp.* (*natans*?) *affine* SCHNITZLEIN. På etiketten till ett ark i U har FRIES skrivit: *Sp. natans* var. *affine*, Bolmen vid Odensjö, 1857.

Vi återvända nu till *Sp. glomeratum* LÆST. och till den förut ställda frågan, hur denna kommit att bära namnet *fluitans*. Vi hänvisar ock till FRIES' ovan citerade anmärkning i Femsjöfloran, där han framställer sin β *fluitans* närmast som en systematiskt värdelös ståndortsform.

Under sina senare *Sparganium*-studier har FRIES tydligen kommit underfund med att *Sp. glomeratum* är en särskild art. Detta framgår tydligt av diagnoser 1849, såväl i hans Summa Veg. Scand. II, s. 559—560, som i Bot. Not. 1849, s. 154. Han kallar den emellertid *Sp. fluitans* FR., Fl. Hall. p. 139, och under detta namn har också hans son givit en god avbildning av växten i Bot. Not. 1852.

När LÆSTADIUS skrivit den ovan citerade etiketten torde väl ej kunna

exakt avgöras, men sannolikt har det skett 1843 eller ej långt därefter. Av dess ordalydelse att döma är det troligt, att Læstadius konfererat med den sex år äldre Fries angående den nya växten. Man måste då fråga sig, varför Fries, sedan han själv lärt känna den i naturen, ej använde Læstadii namn på den, utan i stället upptog sitt 30 år gamla namn *fluitans*. Ty 1849 måste han ha insett, att detta innefattade flera olika saker.

Med hänsyn till ovan relaterade fakta kan jag ej komma till annat resultat än att han ej ville helt kassera sitt gamla namn β *fluitans*. Och så fick Læstadii art sitt otympliga namn. Genom Fries' auktoritet upptogs detta av hans lärjungar och blev gängse i vår floristiska litteratur, ända tills Neuman (1889, s. 111) återgav den dess rätta namn.

Zusammenfassung. *Sparganium fluitans — glomeratum — affine. Eine schwer zu lösende Nomenklaturfrage.* — In der Flora von Skandinavien ist die Gattung *Sparganium* von sieben Arten vertreten. Bei fünf von diesen sind Schwimmblätter normalerweise vorhanden oder kommen jedenfalls gewöhnlich vor. Dagegen sind solche bei *Sp. ramosum* und *Sp. glomeratum* sehr selten zu finden. Der Verfasser hat sich deshalb die Frage gestellt, weshalb eine von diesen — *Sp. glomeratum* Læstadius in Schaed. 1843 — in unsrer floristischen Literatur schon lange den schlecht passenden Namen »*fluitans*» Fr. 1849 getragen hat.

Literaturstudien und Studien von Etiketten in unseren botanischen Museen haben den Verfasser zur Schlussfolgerung gebracht, dass Fries diese Art verhältnismässig spät kennenlernte. Etwa 30 Jahre früher hatte er in seiner Flora Hallandica eine *Sp. simplex* β *fluitans* festgestellt. Während seiner späteren *Sparganium*-Studien aber dürfte er gefunden haben, dass unter dem letztgenannten Namen verschiedenes eingeräumt werden konnte. Da er aber den von ihm gegebenen älteren Namen nicht ganz missen wollte, hat er diesen der *Sp. glomeratum* gegeben. Die grosse Autorität von Fries dürfte seine Schüler veranlasst haben, »*fluitans*» zu behalten, und so wurde dieser Name in der floristischen Literatur bis 1889 geläufig. In diesem Jahre wurde Læstadius' Name von Neuman wieder aufgenommen.

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Göteborg den 14 mars 1954.

F. Hård av Segerstad.

Fynd av Chara tomentosa L. och ett par andra alger från Björklinge-Långsjön, Uppland.

Ytterligare ett fynd av *Chara tomentosa* L. ♂ från det centrala Uppland kan anmälas. 27.VIII. 1953 påträffade jag nämligen arten i Långsjön, Björklinge s:n, Uppland (ungefär vid »i» i Björklinge, top. kartbladet 92 Östhammar). Förekomsten är sparsam. Algen växer inom ett 0,5—1,0 m djupt område på den i Långsjön ganska branta sluttningen ner mot djupare vatten.

Vängsjön, Gottröra s:n, där *Chara tomentosa* förekommer i stor mängd (Willén 1953), tillhör den karakteristiska *Chara*-sjötypen, som eljest företrädesvis påträffas i östra Uppland. Långsjön (26,7 m ö. h.) skiljer sig däremot från flertalet uppländska sjöar. Bl. a. är vattnet ovanligt klart (högsta transparensvärde 610 cm, 7.X. 1951) beroende på, att sjön till stor del mottager tillflöden från Uppsalaåsen, som drager fram längs sjöns södra och västra strand.

Ett tillflöde från åsen i sjöns SV-del observerades ett 10-tal m från *Chara*-lokalen. Källflödet mynnade dels på stranden, dels med flera porer under vattenytan. Runt dessa växte *Chara aspera* Willd. ♀ och ♂ i mycket täta mattor. — Temperaturen uppmättes till 18°,4 C ute i sjön och till 7°,8 C i källflödet på stranden. Vattenfärgen var 5° resp. 2° Hazen och spec. ledningsförmågan ($\varkappa_{20} \cdot 10^6$) 535 i sjön och 570 i källflödet.

På några *Chara tomentosa*-exemplar växte *Batrachospermum moniliforme* Roth (fig. 1) och enstaka exemplar av *Chaetophora incrassata* (Huds.) Hazen (jfr Luther 1953). Den senare arten förekommer mycket allmänt i sjön. — *Batrachospermum moniliforme* växer ofta på kvistar, rotsystem etc. och förekommer på exempelvis *Equisetum*, *Typha* och *Phragmites* i sjöar. Mycket få uppgifter föreligga dock om batrachospermer växande på characéer (Reinsch 1875). Herbariematerial förekom i Berlin-Dahlem-museet, granskat av professor H. Skuja. Även i detta fall utgjordes påväxten av *B. moniliforme*.

På *Batrachospermum* slutligen växte grönalgen *Chaetonema irregulare* Nowak. Den förekommer allmänt i olika större sötvattensalgers slemhöljen och kan ofta helt överdraga en *Batrachospermum*, som växer i lugnt vatten, med sina trådar.

Fig. 1. *Batrachospermum moniliforme* växande på *Chara tomentosa*. Långsjön, Björklinge s:n, Uppland. — Båda fig. c:a 3 ×.

CITERAD LITTERATUR.

LUTHER, H., 1953: Über die nordische Verbreitung von Chaetophora incrassata (Huds.) Hazen. — Bot. Not. Lund.

REINSCH, P. F., 1875: Contributiones ad Algologiam et Fungologiam. — Lipsiae.

WILLÉN, T., 1953: Najas marina och Chara tomentosa från sötvatten i Uppland. — Sv. Bot. Tidskr., 47. Uppsala.

Torbjörn Willén.

Botaniska exkursionsanteckningar från Västmanland.

Den 5 juni 1954 besökte undertecknad Ängsön, Fagerön och Långholmen i Ängsö socken. Speciellt Ängsön hyser en mycket intressant och rik flora med inslag av många kalkälskande arter. Fagerön är intressant främst tack vare sina branta stränder. Följande arter av intresse noterades.

Fagerön:

Asplenium septentrionale och *Woodsia ilvensis*. Allmänna i stupen i NV.

A. trichomanes. Några ex. i en fuktig skreva i NV. Arten är här i trakten den ovanligaste av de tre småormbunkarna. Omkring 10 lok. äro kända i Västeråstrakten. Oftast förekommer arten tillsammans med de båda föregående.

A. septentrionale x *trichomanes*. Ett vackert ex. bland föräldrarna på en skuggig klipphylla. Hybriden är i denna del av Västmanland endast känd från två berg i trakten av Köping.

Botrychium Lunaria. Ett ex. på torr betesmark NV om Fagerö gård. Arten är nog mycket förbisedd och ej så sällsynt, som de 4 lokalerna i Västeråstrakten utvisar.

I närheten av Fagerö gård sågos *Cynoglossum officinale*, *Pedicularis palustris* och *Cardamine impatiens*. Den senare är ej ovanlig på Mälaröarna.

Långholmen.

Neottia Nidus-avis. Ett ex. i knopp vid skogsvägen öster om Västerudden. Arten är uppgiven från två lokaler nära Västerås samt från en ö i Ängsösundet. Från det sistnämnda stället försvann nästroten för tjugu år sedan. Troligen söker man den nu förgäves även på de förstnämnda platserna.

Corallorhiza trifida. Omkr. 20 ex. i sankmarkerna SV om St. Långholmen.

Lathyrus niger. Lundmark SV om St. Långholmen.

Anagallis femina. Ett stort ex. hösten 1953 i hamnområdet vid Karlberg, Västerås (enl kemist GÖSTA ERICSSON). Arten är mig veterligen endast en gång tidigare uppgiven från Västeråsområdet.

Ingvar Nordin.

RECENSIONER.

Howard S. Reed, Jan Ingenhousz, Plant Physiologist. With a History of the Discovery of Photosynthesis. — Waltham, Mass.: The Chronica Botanica Co.; Uppsala: A.-B. Lundequistska Bokhandeln. 1949. 3:— doll.

I början av 1770-talet hade Joseph Priestley funnit, att växter kunde rena fördärvad eller »flogistiserad» luft, så att den åter kunde underhålla andning och förbränning. Vid fortsatta försök fann han emellertid att resultatet ej sällan uteblev, och därtill kom att vatten, som användes som avspärrningsvätska vid försöken, ibland kunde avge »deflogistiserad luft» (syrgas). Särskilt var detta fallet när en »grön materia» (vars organiska karaktär först något senare blev klarlagd) avsatt sig på kärlens väggar, vilken materia i solljus kunde ge upphov till en jämn ström av gasbubblor. Scheele var samtidigt sysselsatt med undersökningar över växternas inverkan på luftens sammansättning. Han fann, att groende ärtor kvantitativt omvandlade »eldsluft» (deflogistiserad luft, syrgas) till »luftsyra» (fix luft, kolsyra), och var därmed den förste som korrekt beskrev växternas respiration. Vid efterprövningen av Priestleys försök inneslöt han bl.a. gröna växtdelar i luft som befriats från såväl »eldsluft» som »luftsyra», och erhöll som naturligt var genomgående negativa resultat.

Sådant var utgångsläget när den holländske läkaren Jan Ingenhousz trädde till. Ytterligare en utgångspunkt hade han i schweizaren Bonnets iakttagelser över bildningen av gasbubblor på blad som höllos under vatten i solljus, vilka denne själv feltolkat såsom beroende på en värme-betingad utvidgning av vanlig, vid bladytan häftande luft. Ingenhousz stoppade nu gröna skott i ett vattenfyllt kärl av genomskinligt glas, vilket i inverterat läge placerades i ett större kärl med samma vatten, och omedelbart exponerades i solen. På några timmar kunde han på så sätt uppsamla avsevärda mängder av »deflogistiserad luft», som underhöll livlig förbränning och vars blandning med »nitrös luft» (NO) visade stark volymkontraktion. För att få ett lyckat resultat måste dock experimentatorn använda ett lämpligt vatten: »he labours in vain, if he does not make use of pump-water freshly drawn». I mindre utsträckning gjorde Ingenhousz även försök med blad inneslutna i luft som fördärvats genom andning, och fann att de i solljus på ett par timmar »förbättrade» den till en kvalitet motsvarande den vanliga luftens. Han visste att brunnsvatten ansågs innehålla »fix luft», men hade funnit att blad, vilka höllos i vatten som var övermättat med »fix luft», gav en mindre god »deflogistiserad luft», en iakttagelse som kan ha bidragit till hans oförmåga att inse kolsyrans roll vid assimilationen. Den upptäcktes några år senare av schweizaren Senebier.

En annan orsak till INGENHOUSZ' oförmåga att inse kolsyrans roll låg i den begreppsförvirring, som betingades av den härskande flogistonteorin. Luftens »fördärvande» eller »förgiftning» vid andning och förbränning ansågs bero på dess impregnering med eldämne eller flogiston. Att växterna trivdes väl i »fördärvad luft» ansåg INGENHOUSZ, i anslutning till PRIESTLEY, bero på att de som näring upptogo flogiston, och det förefaller osannolikt att han fattat betydelsen av SCHEELES undersökningar av händelseförloppet vid luftens »fördärvande». Han visste att alla växtdelar fördärvade luft i mörker, och att blommor, rötter och en del frukter göra det även i ljus, men därvid slutade hans filosofiska intresse för denna sak och det praktisktmedicinska tog vid. Växterna förbättra visserligen luften i betydligt större omfattning om dagen än de försämra den under natten. Men man må taga sig i akt. Många växter i ett trångt rum kan mycket väl vara förklaringen till annars gåtfulla dödsfall, och i blommornas doft lurar likaledes döden: »The air itself, which they have poisoned, is impregnated with the same fragrant smell as the flowers themselves; so that a person, not aware of the concealed poison which flowers spread round about them, might be easily induced by the sweetness of their scent to run the greatest hazard of losing his life, without the smallest apprehension of danger.» Livad av sina upptäckter av bladens förmåga att förbättra luften och göra den hälsosammare undersökte INGENHOUSZ även de bubblor, som kunde avskrapas från huden av en i vatten nedsänkt arm. Särskilda försök övertygade honom emellertid därom »that the air evaporating from the skin of young people is not purer than that emitted from the skin of people more advanced in years; and that if there should be any advantage for old people to sleep in the same bed with young ones, as some imagine, it cannot likely be owing to their perspiring a better and wholesomer air from their skin».

Såsom torde framgå av det föregående är det en sällsam blandning av banbrytande iakttagelser och kuriösa idéer som möter oss i INGENHOUSZ' verk, och det är väl denna blandning som åt detta, liksom åt många andra tidiga dokument ur vetenskapens historia, ger en säregen charm för den moderne läsaren. En bekväm möjlighet att stifta en närmare bekantskap med INGENHOUSZ ger ovanstående arbete, bakom vars titel döljer sig en edition av hans »Experiments upon Vegetables», London 1779. Tyvärr är texten hårt beskuren, i det att beskrivningarna av de enskilda experimenten ej ens fått komma med i urval. I stället bjudes läsaren en tämligen illa disponerad och delvis förvirrande kommentar. Att i ett dylikt sammanhang ge ett fragmentariskt referat över de nyaste faserna i fotosyntesens utforskande är ovidkommande, och tillgängligt utrymme borde i stället ägnats åt INGENHOUSZ' mera närliggande grannar i vetenskapens historia. Inte ens hans egen utveckling efter »Experiments» är tillfredsställande belyst. Ett reproducerat avsnitt ur den franska upplagan av år 1789 ger ingenting väsentligt nytt, och i stället skulle man önskat sig ett utförligt referat med lämpliga text-citat av hans »Essay on the Food of Plants and the Renovation of Soils» av år 1796, där han som den förste tillämpar LAVOISIERS revolutionerande kemiska idéer på fotosyntesen och, utan att nämna SENEBIER, på ett riktigt sätt infogar kolsyran i sammanhanget.

Börje Åberg.

Symposia of the Society for Experimental Biology, Number V: Carbon Dioxide Fixation and Photosynthesis. — Cambridge: at the University Press. 1951. Pris: 42 shill.

Från Ingenhousz (se föreg. rec.) ta vi så ett långt språng framåt i tiden till en av de modernaste översikterna över vårt aktuella vetande om fotosyntesen. Den avser ej att täcka hela området utan behandlar valda avsnitt, vilka i stor utsträckning sammanfaller med de frontavsnitt, där forskningen för närvarande är särskilt aktiv och framgångsrik.

Som bekant anser man sig numera kunna urskilja två huvudfaser i växternas kolsyreassimilation eller fotosyntes, nämligen å ena sidan vattnets sönderdelning under bildning av syrgas och ett reducerande agens, samt å den andra kolsyrans bindning och de därvid bildade produkternas reduktion till kolhydraternas nivå. Den första processen kan utföras av isolerade kloroplaster, vilka suspenderats i en vattenlösning innehållande bl.a. ett lämpligt oxidationsmedel, som tar hand om det frigjorda vätet, medan syret bortgår i gasform. Det målmedvetna studiet av detta fenomen inleddes av R. Hill (Cambridge), efter vilken det fått beteckningen »Hill-reaktionen». Han medverkar i föreliggande symposium med ett försök att kvantitativt precisera kloroplasternas tendens att sönderdela vatten och med en diskussion av den därvid verksamma oxidations-reduktions-kedjans natur. Härvid skildrar han även det nyupptäckta, till kloroplasterna lokaliserade cytokrom f, som möjligen medverkar i fotosyntesen på ett ännu icke klarlagt sätt. Kloroplasterna behöva icke vara hela för att kunna katalysera Hill-reaktionen. Tvärtom framgår det klart av det bidrag som lämnats av C. S. French och H. W. Milner (Stanford, Calif.), att de kunna fragmenteras till stycken av kolloidal storlek utan att förlora denna förmåga. Vid fragmenteringen separeras ej kloroplasternas grana från stromat, och det har hittills ej lyckats att förknippa »Hill-aktiviteten» med någon viss fraktion av deras substans.

På vilka vägar den av klorofyllet upptagna ljusenergin bringas att medverka vid vattensönderdelning och kolsyre-reduktion i fotosyntesen är ännu en öppen fråga. Det ligger närmast till hans att antaga, att endast den förstnämnda processen är direkt fotokemisk, men eftersom redan denna säkerligen är sammansatt av flera, ännu okända delreaktioner, är det naturligt att diskussionen tillsvidare måste hållas på ett mycket allmänt plan. Den företrädes i detta sammanhang av M. G. Evans ocb N. Uri (Manchester) samt av Joseph Weiss (Newcastle-on-Tyne), vilka behandla reaktionsmekanismerna hos vissa, relativt väl kända, fotokemiska oxidations-reductions-processer i vattenlösningar, samt de lärdomar som ur dem kunna dragas för förklaringen av Hill-reaktionen. E. J. Bowen (Oxford) ger vidare en klar och översiktlig framställning av energitransport mellan molekyler genom resonans, en process som kan äga rum mellan klorofyllmolekyler, och James Franck (Chicago) diskuterar bl.a. relationerna mellan klorofyllets fotokemiska aktivitet och dess fluorescens. Han anmäler därvid avvikande meningar gentemot E. C. Wassink (Wageningen), som också bearbetat detta problem.

Den andra huvudprocessen i fotosyntesen inledes som nämnts genom kolsyrans bindning, en process som först påvisades hos vissa heterotrofa

bakterier, men som sedan visat sig förekomma tämligen allmänt inom såväl djur- som växtriket. I princip utgör denna bindning en omvändning av kolsyre-avgivningen vid andningen, och kolsyran hamnar först i en karboxyl-grupp (-COOH). Ett exempel på en principiellt reversibel dekarboxylering är oxalättiksyrans sönderdelning i pyrodruvsyra och kolsyra:

$$COOH \cdot CO \cdot CH_2 \cdot COOH \rightleftharpoons CH_3 \cdot CO \cdot COOH + CO_2. \quad (1)$$

Jämvikten är emellertid mycket starkt förskjuten åt höger, och för en effektiv bindning av kolsyra måste oxalättiksyran bortskaffas allteftersom den bildas. Detta skulle kunna tänkas ske exempelvis genom enzymatisk reduction till äppelsyra under medverkan av trifosfopyridinnukleotid (TPN, coenzym II):

$$COOH \cdot CO \cdot CH_2 \cdot COOH + \\ + TPN_{red} \rightleftharpoons COOH \cdot CH(OH) \cdot CH_2 \cdot COOH + TPN_{ox}. \quad (2)$$

Tillsammans ger reaktionerna (1) och (2) följande resultat:

$$CH_3 \cdot CO \cdot COOH + CO_2 + \\ + TPN_{red} \rightleftharpoons COOH \cdot CH(OH) \cdot CH_2 \cdot COOH + TPN_{ox}. \quad (3)$$

Det märkliga har nu inträffat, att denna sammansatta reaktion visat sig vara svår att åstadkomma med hjälp av de enzymer som katalysera reaktionerna (1) och (2), men däremot förlöper lätt med hjälp av ett till synes enhetligt enzym, Ochoas äppelsyreenzym, vilket har påvisats i såväl animala vävnader som växtvävnader. Närmare data om dessa intressanta förhållanden samt om andra karboxyleringsreaktioner kan inhämtas i de fyra första uppsatserna i föreliggande symposium, vilka bland sina författare räkna pionjärena på området: H. G. Wood (Cleveland, Ohio), S. Ochoa (New York) och H. A. Krebs (Sheffield). Ett viktigt bidrag lämnas även av D. Herbert (London).

Att äppelsyre-enzymet här ägnats relativt stor uppmärksamhet sammanhänger därmed, att isotop-försök visat att äppelsyran uppträder som fotosyntetisk huvudprodukt vid mycket låg ljusstyrka samt att den även kan bildas vid kolsyrefixering i mörker. Den senare processen kan under vissa faser i succulenternas ämnesomsättning bli så stark, att den överväger över den respiratoriska kolsyreavgivningen, med en samtidig upptagning av syre och kolsyra som följd, ett fenomen som först observerades av De Saussure för 150 år sedan (se M. Thomas' bidrag om »Crassulacean Acid Metabolism»). Det har vidare visats att TPN kan fungera som väteacceptor i Hill-reaktionen, och i ett system innehållande kloroplaster, TPN, pyrodruvsyra, kolsyra samt äppelsyre-enzym har faktiskt en fotosyntetisk äppelsyrebildning kunnat påvisas.

Konstruktionen av ett dylikt modellsystem är givetvis en mycket stor framgång, men det bör genast sägas att den naturliga fotosyntesen sannolikt följer helt andra metaboliska linjer, vilkas urforskande möjliggjorts av isotop-tekniken (C^{14}) och de kromatografiska analysmetoderna. Såväl Calvins grupp i Berkeley som Gaffrons i Chicago, vilka båda medverkat

i symposiet, ha lämnat väsentliga bidrag, och äro numera ense därom att den första stabila produkten av fotosyntesen är fosfoglycerinsyra, från vilken en sidogren leder bl.a. till pyrodruvsyra, äppelsyra etc. Fosfoglycerinsyran reduceras troligen delvis vidare till fosfoglycerinaldehyd och fosfodihydroxyaceton, vilka kondenseras till fruktosdifosfat, som därpå kan transformeras till sackaros. Det viktigaste av de återstående problemen synes vara att finna den primära acceptor, som med kolsyra ger fosfoglycerinsyra. Möjligen kan det röra sig om en labil förening eller ett labilt komplex, som genereras endast i ljus, och vars sönderfall förklarar processens snabba avklingande i mörker. Efter symposiets avhållande har Berkeley-gruppen identifierat ett pentos- och ett heptos-fosfat bland de ämnen som snabbt inkorporera C^{14} vid fotosyntesen, och de anses möjligen kunna ha något samband med den primära kolsyreacceptorns bildning.

Ljusenergin upptas vid fotosyntesen i form av kvanta, och för varje assimilerad molekyl kolsyra skulle, om ljusenergin kunde fullständigt överföras i kemisk energi, åtminstone omkring 3 kvanta vara nödvändiga. Nu kan en dylik process icke äga rum utan betydande energiförluster, och även ett kvantbehov av 4, som Otto Warburg i början av 1920-talet ansåg sig ha experimentellt fastställt, torde ur denna synpunkt vara förvånande lagt. Amerikanska forskare kunde heller icke verifiera detta låga kvantbehov utan funno i stället åtminstone 8—10 kvanta vara erforderliga. Efter kriget återkom emellertid Warburg till frågan, och med olika manometriska metoder kunde han fortfarande fastställa kvant-behovet 3—5. Kontroversen mellen Warburgs grupp, till vilken sällat sig bl.a. amerikanen D. Burk, och anhängare av det högre kvanttalet, vilkas talan föres framförallt av Robert Emerson (Urbana, Ill.), kan med fördel studeras i föreliggande symposium. För icke-specialisten torde det vara svårt att penetrera den manometriska teknikens subtila finesser och lömska fallgropar, och man frestas lätt att ställa sina förhoppningar till nya typer av mätmetoder. Oberoende av mättekniken äro emellertid de vanskligheter, som uppkomma genom en möjlig interferens mellan respiration och fotosyntes, och som skulle kunna vara av väsentlig betydelse framförallt vid låga ljusstyrkor. Ett viktigt bidrag till belysandet av denna fråga lämnas av B. Kok (Wageningen), som funnit en tydlig ändring i sambandet mellan ljusintensitet och fotosyntes i närheten av kompensationspunkten. Helt nyligen har förövrigt E. Steemann Nielsen (Physiol. Plant. 1953) funnit denna effekt uppträda endast vid höga kolsyrekoncentrationer, och tolkat den som en i ljus uppträdande kolsyrehämning av respirationen.

Huvudparten av de moderna undersökningarna över fotosyntesens biokemi och kinetik har utförts med encelliga alger (*Chlorella*, *Scenedesmus*) eller rent av med isolerade kloroplaster som objekt. Därigenom undviker man de komplikationer, som lätt tillstöta vid studiet av samma processer i exempelvis de mer komplicerat byggda blad-organen. Bland annat blir här kolsyretransporten in genom klyvöppningarna lätt en svårbemästrad faktor. Ett par bidrag till belysandet av hithörande frågor ingå i symposiet. O. V. S. Heath (London) beskriver assimilationsförsök, där luften ej såsom vanligt ledes fram över bladets ytor utan tvingas att gå igenom detsamma, och där alltså hela luftmassan kommer i intim kontakt med mesofyllcel-

lerna. Trots varierande kolsyremängd i den inströmmande luften vidmakthålles ett förvånande konstant värde (omkr. 0,01 %) i den utströmmande luften. Detta tröskelvärde för bladcellernas förmåga att uppta kolsyra, som med andra metoder fastställts även av E. K. Gabrielsen, är uppenbarligen av stort intresse, även om tolkningen av dess innebörd ännu ej är fullt klar. Om så till denna undersökning lägges en fysikalisk diskussion av diffusionsmotstånden vid bladens kolsyreupptagning och vattenavgivning av H. L. Penman och R. K. Schofield (Rothamsted), där bl.a. betydelsen av det yttre, vid diffusionen fram till bladytan uppträdande motståndet understrykes, har det intressanta-symposiets innehåll tämligen fullständigt redovisats.

Börje Åberg.

A. S. Crafts, H. B. Currier and C. R. Stocking, Water in the Physiology of Plants. — Waltham, Mass.: The Chronica Botanica Co.; Uppsala: A.-B. Lundequistska Bokhandeln. 1949. 240 sid. Klotband, 6: 00 doll.

Vatten är en ganska egendomlig vätska, som, om den behagat följa vanliga regler, skulle haft en kokpunkt någonstans nedåt − 80° C (jämför svavelväte, kokpunkt − 61° C). Avvikelsen beror på vattenmolekylernas tendens att med hjälp av bl. a. väte-bindningar och dipol-attraktioner kopplas ihop till ett plastiskt nätverk, och samma slags krafter är av stor vikt vid betingandet av vattenlösningarnas egenskaper, vid kolloidernas svällning etc. I den aktiva, levande cellen ingår som bekant vatten till en hög procentsats, och i sitt samspel med den komplicerade massan av lösta ämnen och kolloider har det stora möjligheter att göra sina speciella egenskaper gällande.

Vattnets roll i växternas fysiologi — ja, strängt taget är det svårt att finna de delar av fysiologin som inte faller under denna rubrik, och kommer man att tänka på någon speciell del så blir det väl närmast frågan om vattenhushållningen, gärna med en viss tonvikt på dess fysiologiskt-ekologiska aspekter. Efter sådana linjer är nu ovanstående arbete ingalunda avgränsat. I stället utgår det från vattnets inledningsvis antydda fysikaliskt-kemiska egenskaper, dröjer ett slag vid lösningarnas teori och svällningsfenomenen, ägnar sedan lejonparten av utrymmet åt de osmotiska fenomenen och deras komplikation genom den eventuella förekomsten av »aktiv vattenupptagning», samt skildrar till slut tämligen utförligt vattenledningen genom xylemet och transpirationsfysiologins grunddrag. Om därtill lägges, att arbetet avsetts huvudsakligen som en handbok med koncisa referat av en stor mängd speciallitteratur (omkr. 750 referenser) bör dess karaktär vara tämligen väl angiven. Det refererade materialet har givetvis infogats i en fortlöpande, kritisk framställning, och författarnas förhoppning att arbetet även skall kunna tjäna som hjälpmedel vid avancerade studier synes väl grundad.

Den osmotiska terminologin ansluter sig såsom numera brukligt i engelskspråkig litteratur till det av B. S. Meyer lanserade systemet, där t. ex. »sugkraft» ersätts med det mera logiska men tyngre »diffusionstrycksdeficit». Osmosens fysikaliska bakgrund, de osmotiska storheternas sammanhang

och metoderna för deras mätning skildras utförligt. De diskrepanser, som kunna uppträda vid parallella bestämningar av osmotiska värdet (trycket) på plasmolytisk och kryoskopisk väg bilda inkörsporten till kapitlet »Active cell water relations». Den ur en vävnad utpressade saften visar ej sällan ett lägre osmotiskt värde än det för cellsaften plasmolytiskt funna. Uppenbarligen är det mycket äventyrligt att sätta likhetstecken mellan pressaft och ursprunglig cellsaft, men trots detta ha vissa forskare varit snabba att postulera en aktiv, non-osmotisk inpumpning av vatten i vakuolen. Vidare har den auxin-inducerade vattenupptagning, som äger rum hos potatisskivor o. dyl., betecknats såsom likaledes »aktiv». Hypotetiska mekanismer (elektro-osmos) för en dylik vattenupptagning kunna konstrueras och den har de senaste åren även antagits spela en roll i den normala cellsträckningen. Författarna till föreliggande handbok ta inte bestämd ståndpunkt till frågan, och diskussionen har sedermera gått vidare. Att en avsevärd roll för en non-osmotisk inpumpning av vatten i cellen blir osannolik redan på grund av plasmans höga vattenpermeabilitet och den därav följande höga energiåtgången vid upprätthållandet av ett stationärt tillstånd, har med skärpa framhallits av Levitt (Physiol. Plant. 6, 1953), och Burström (*ibid.*) kunde vid en analys av den auxinbetingade vattenupptagningen hos jordärtskocksvävnad icke verifiera de påstådda avvikelserna från normala osmotiska förhållanden.

Blödningsfenomenen, de fysiologiska effekterna av vattenbrist, och vattentransporten i submersa växter kan nämnas som exempel på områden, vilka, vid sidan av ovan antydda huvudavsnitt, tas upp åtminstone till kortfattad behandling. I övrigt må den intresserade själv orientera sig i den innehållsrika volymen, som av naturliga skäl icke kan uttömmande beskriva alla faser av vattnets roll i växternas fysiologi, men dock kan förmedla, och väl snarast uppställt som sitt mål att förmedla, en allmän bakgrund för bedömningen av de mångfaldiga specialproblemen.

Börje Åberg.

E. Bünning, Lehrbuch der Pflanzenphysiologie. II. und III. Band: Entwicklungs- und Bewegungsphysiologie der Pflanze. Dritte Auflage. — Springer-Verlag, Berlin 1953. 539 sid. DM 49: 60; Ganzleinen DM 54: 60.

Bünnings lärobok torde vid det här laget vara välbekant för ett stort antal botanister. Dess första upplaga utkom 1939 och omfattade tillväxtens och rörelsernas fysiologi. Nästa upplaga (1948) hade utvidgats till att omfatta även utvecklingens fysiologi. Bokens omfattning hade därigenom vuxit från 267 sidor med 233 bilder till 464 sidor med 404 bilder, och efterkrigstiden hade satt sitt spår i form av starkt försämrat papper. I den nu föreliggande tredje upplagan är titeln oförändrad, papperet och trycket är åter av högsta kvalitet, och omfattningen har ytterligare ökat till 539 sidor med 479 bilder. Ökningen beror till större delen på inarbetandet av nytt och värdefullt material, men kan givetvis ses ur olika synpunkter när det gäller en lärobok. Lyckligast vore nog om platsen för det nya kunde vinnas genom att göra framställningen av andra avsnitt kortare och koncisare.

I sin anmälan av den första upplagan (Svensk Bot. Tidskr. 34: 58, 1940) framhöll Stålfelt framställningens starka koncentration till de principiella sammanhangen, kring vilka detaljbeskrivningarna grupperas som exempel, och häri har säkerligen boken såväl sin styrka som sin svaghet. Metoden leder till en stimulerande och lättläst framställning, men den frestar kanske också till en alltför stark betoning och uttänjning av hypoteser, som relativt snart kan visa sig mogna att ersättas av andra.

Utvecklingsfysiologin behandlar det komplicerade samspel av tillväxt- och differentieringsprocesser, som, reglerat av arvsfaktorer och miljö, leder till växtens aktuella tillstånd. Ytterst förutsätter den en syntes av fysiologi och genetik, som länge har verkat utopisk, men som numera kan sägas vara på väg. Bünnings behandling av detta vanskliga område, som först infördes i föreliggande arbetes andra upplaga och nu återkommer i starkt bearbetat och utvidgat skick, torde vara enastående i sitt slag i den botaniska lärobokslitteraturen. Tumörartad tillväxt med utebliven differentiering, somatiska mutationer, polaritet och inekval delning, mönsterbildning vid vävnadsdifferentieringen, determinering genom angränsande celler och vävnader samt genom hormoner, determinationens stabilitet etc. är rubriker som kan ge en viss uppfattning om detta avsnitts innehåll. Kärndelningens och genverkningarnas fysiologi, plasmon- och plastidomverkningar etc. hör till de för utvecklingsfysiologin grundläggande problem åt vilka stor uppmärksamhet ägnas.

Framställningen av tillväxtmekanismerna har i stort sett fått behålla sin disposition. Det viktigaste av det nya material, som inarbetats i avsnittet om sträckningstillväxten, utgöres av mera konkreta data om cellväggarnas finstruktur, bland annat i form av en serie goda reproduktioner av elektronmikroskopiska bilder. Detroniseringen av auxinerna »a» och »b» har genomförts, men är ännu som sig bör villkorlig. Avsnittet om plasmatillväxtens mekanism är grundligt omarbetet, bl.a. med hänsyn till nukleinsyrornas allt klarare framträdande roll.

Minst förändrade är avsnitten om rörelsemekanismerna och de yttre faktorernas verkningssätt. Bland nytillskotten i kapitlet om ljusverkningarna kan en notis om interferensfilterna, ett avsnitt om laktoflavinets roll som receptor samt en betydligt mera detaljerad framställning av de fotoperiodiska effekternas spektralberoende nämnas. Hopkopplingen av de nämnda effekterna med den endogena rytmiken är som idé tilltalande, men har i den tidigare framställningen varit svår att följa. Nya slående argument har nu tillfogats, och den svårighet, som förut låg i antagandet av en »skotofil» fas hos långdagsväxterna, har mildrats genom att denna fas alternativt ersatts med en indifferensfas. Faktiskt är det ju bara kortdagsväxterna, som behöver »sova» på natten och sedan raskt och morgonpiggt går över till den fotofila fasen, medan långdagsväxterna, om den något fria liknelsen tillåts, mera överensstämmer med de långsamt vaknande, morgonsömniga människorna.

Bünnings arbete har från början annonserats såsom ingående i en planerad, fullständig växtfysiologisk lärobok, där en väsentlig del av ämnesomsättningens fysiologi låtit vänta och ännu låter vänta på sig. Goda substitut för denna del finnas dock, och uppdelningen har såtillvida varit lycklig som vi

genom den fått en lärobok som koncentrerar sig helt till områden, vilka i många andra — och särskilt i amerikanska — framställningar fått en oförtjänt undanskymd ställning. Den vänder sig kanske också i högre grad än specialframställningar av den biokemiskt inriktade ämnesomsättningsfysiologin även till företrädare för angränsande botaniska discipliner. Det är därför med goda skäl man kan förutspå och tillönska boken en vidsträckt läsekrets.

Börje Åberg.

Strasburger, Noll, Schenck und Schimper: Lehrbuch der Botanik, 26. omarbetade upplagan, bearbetad av Fitting, Schumacher, Harder och Firbas. — G. Fischer, Stuttgart 1954. 651 sid. Pris 28 DM.

En ny upplaga av denna välkända lärobok har åter utkommit tre år efter den närmast föregående. Utgivarna äro desamma som i den sistnämnda. Denna nya upplaga skiljer sig emellertid i vissa avseenden rätt avsevärt från den föregående. I den morfologiska delen ha särskilt kapitlen om kärndelning och kromosomernas byggnad delvis omarbetats, och flera nya, goda avbildningar ha tillkommit. En tråkig förändring är dock, att de mycket instruktiva schematiska färgbilder, som i föregående upplagor åskådliggjort skillnaden mellan mitos och meios, nu ha utbytts mot bilder i svartvitt, där olika slags streckning ersätter färgerna.

I den del som behandlar de lägre växternas systematik har Harder gjort ett flertal välmotiverade förändringar. Endast ett par exempel skola nämnas. Inom klassen *Chlorophyceae* har den stora och heterogena ordningen *Ulotrichales* i överensstämmelse med moderna algologiska handböcker delats i tre ordningar, nämligen *Ulotrichales* sens. str., *Chaetophorales* och *Oedogoniales*. Indelningen bygger i första hand på thallus utbildning samt på svärmarnas ciliering. Vidare har familjen *Dasycladaceae* överförts från *Cladophorales* (tidigare *Siphonocladiales*) till *Siphonales*. Inom Ascomyceterna ha även en del förändringar vidtagits. Med tillfredsställelse kan nämnas, att de högre Ascomycetordningarna nu grupperas enligt Nannfeldts system i huvudgrupperna *Ascoloculares* och *Ascohymeniales*. I slutet av Ascomyceterna har åter införts ordningen *Laboulbeniales*, som varit struken i de närmast föregående upplagorna. Den omnämnes dock endast på ett par rader. Man skulle nog önska en något utförligare framställning av denna såväl fylogenetiskt som biologiskt mycket intressanta lilla grupp.

I de högre växternas system synas inga mera omfattande ändringar eller tillägg ha gjorts. Inom *Polycarpiceae* har dock den tämligen nyuppställda familjen *Degeneriaceae* tillkommit. Man fäster sig vid att många av de gamla välkända färgbilderna av ekonomiska orsaker ha måst utgå eller ersättas av teckningar i svartvitt. Texten är liksom i föregående upplagor på många håll mycket knapphändig i denna avdelning. Ofta nämnes ej stort mera än namnet på familjer och ordningar. Man frågar sig om icke exempelvis förteckningarna över drogväxter i slutet av varje ordning med fördel skulle kunna strykas, och det vunna utrymmet i stället användas till utökande av de systematiska och fylogenetiska resonemangen.

Gunnar Harling.

R. E. Holttum, Plant Life in Malaya. — Longmans, Green & Co., London, 1954. 254 sid. Pris 18 sh.

Författaren till detta arbete har under drygt 30 år vistats på Malackahalvön, bl.a. såsom chef för botaniska trädgården i Singapore och professor vid University of Malaya. Han har därvid haft rika tillfällen att studera områdets intressanta flora, och bokens innehåll är till stor del baserat på hans egna iakttagelser. Arbetet är dock icke av floristisk utan av biologisk och ekologisk natur. Efter ett inledande avsnitt, som behandlar relationerna mellan klimat och växtvärld inom det berörda området, följa ett antal kapitel om olika livsformer, blomtyper och blombiologi, frukter och frön etc. Bokens senare del behandlar några intressanta biologiska grupper, såsom parasiter och saprofyter, myrmekofila växter och vattenväxter. I slutkapitlet skildras Malayas urskog betraktad i sin helhet, varjämte människans alltmera märkbara inflytande på densamma diskuteras.

Arbetet är rikt illustrerat med ett femtiotal helsideteckningar utförda huvudsakligen på levande material av infödda konstnärer under författarens överinseende. Man skulle kanske dessutom ha önskat några fler vegetationsfotografier; endast ett sådant är medtaget.

Enligt författarens förord är denna bok skriven i första hand för botaniskt intresserade invånare på Malackahalvön, ävensom för lärare och studerande vid dess högre skolor och för nybörjare vid universiteten. Framställningen är också mycket elementär, och boken kan läsas med ganska obetydliga förkunskaper. Den kan rekommenderas till var och en som önskar utöka sin kunskap om de tropiska växternas livsförhållanden.

Gunnar Harling.

Stella Ross-Craig, Drawings of British Plants. Part V, VI. — G. Bell & Sons Ltd, London, 1951, 1952. Pris 10s. vardera.

För alla som sysslar med floristiska eller systematiska arbeten är goda avbildningar till stor hjälp och vägledning. Hur väl genomtänkt och uttömmande en skriftlig diagnos än kan vara, bildar illustrationer ett värdefullt och i vissa fall nästan nödvändigt komplement. Detta naturligtvis under förutsättning att de är exakta och ur teknisk synpunkt oklanderliga.

Tid efter annan blir man i Sverige påmind om detta förhållande. Vi saknar ju en modern och komplett behandling av den svensk floran i bild i motsats till våra grannländer i väster, där sådana arbeten är under utgivning. Den senaste påminnelsen lämnar Stella Ross-Craig med sina häften »Drawings of British Plants». Närmast ska häfterna V och VI behandlas här. Häfte V ägnas helt åt *Caryophyllaceae* och häfte VI åt 13 mindre familjer, bl.a. *Hypericaceae*, *Malvaceae* och *Geraniaceae*. Många arter har säkert varit tacksamma att avbilda, de har haft stora och tydliga blommor och ett växtsätt som gör sig på bild. Stötestenarna har emellertid säkert också varit åtskilliga och det är, för att taga ett exempel, en mycket skicklig prestation att teckna de fin- och tätbladiga individen av en del caryophyllacéer, speciellt inom *Alsinoideae*, utan att de på något sätt förlorar i tydlighet. Allra bäst framträder nog detta i fråga om *Spergularia marginata*.

Samtliga planscher är uppställda efter samma princip. Omkring en mycket dekorativ huvudbild, som visar en större eller mindre del av växten i naturlig storlek, grupperar sig detaljfigurer av blomman, frukten och fröet eller delar av dessa. Av större örter finns ibland också en starkt förminskad översiktsbild. Kompositionen är skicklig och centralbilden dominerar oftast så som säkerligen har varit avsikten. Särskilt bland nejlikväxterna inverkar dock de många detaljfigurerna ej sällan ofördelaktigt på helhetsintrycket. Det är beklagligt ur estetisk synpunkt men man får trösta sig med att det mången gång är detaljerna som har det största värdet för bestämningen. Dessutom får man sällan se så väl utförda detaljbilder. Mindre upplysande är enl. anmälarens förmenande de förminskade översiktsbilderna.

Bildernas klarhet beror dock inte bara på en väl genomförd komposition. Lika viktigt har själva framställningssättet varit. De tydliga konturerna är dragna med linjer av i stort sett bara två tjocklekar och en sparsamt använd men därför inte mindre uttrycksfull skuggningsteknik, åstadkommen med mjukt löpande, i huvudsak parallella linjer framhäver växtens olika delar. Naturligtvis kan inte alla bilder vara lika goda. Den ofrånkomliga hårdheten som är en följd av konstnärinnans teknik kan i några fall bli väl påfallande. *Tilia platyphyllos* kan nämnas. På vissa planscher bildar dock mörka eller t.o.m. rent svarta partier en verkningsfull kontrast mot de ljusare, så hos *Rhamnus cathartica*, *Frangula alnus*, *Lavathera arborea* och *Hypericum androsaemum*. *Impatiens*-blommorna kan däremot inte framkalla någon entusiasm. Men det ska villigt erkännas, att deras form är ganska otacksam. Sådana anmärkningar är emellertid rena oväsentligheter. En lustig detalj är att åtskilliga arter verkar så mycket kraftigare än hos oss. Det framträder bl.a. hos *Geranium*. Är det andra ekotyper, — eller har bilderna oavsiktligt blivit en hårsmån förstorade? Ingenting är lättare att göra vid sådana här arbeten.

Bildtexterna är klara och kortfattade, nomenklaturen modern men inte alltid i överensstämmelse med våra namn. Synonymer är utsatta men det skulle inte ha skadat med ytterligare några. Sålunda saknas *Cerastium lapponicum*, som ännu förekommer i vissa av våra floror.

Avsikten är att så småningom avbilda alla arter i den engelska floran. Det är av största värde att en bildflora av denna art inte inskränks till att omfatta endast ett begränsat urval arter. En svensk läsare lägger kanske särskilt starkt märke till detta efter att ha tagit del av Ross-Craigs arbete. Det är nämligen åtskilliga svenska arter som man saknar men gärna skulle ha sett avbildade på samma sätt som de övriga. Vänder man sig till liknande framställningar från t. ex. Norge, gör man samma iakttagelser. Det är därför stor skada, att ett arbete av den typ som »Drawings of British Plants» m.fl. företräder inte kan komma att omfatta ett större floraområde. Men förmodligen är tanken på en ur svensk synpunkt uttömmande bildflora ett fromt men verklighetsfrämmande önskemål och vi får därför vara tacksamma för att Englands flora i alla fall har åtskilliga arter gemensamma med vår egen, så att vi allt som oftast har anledning att studera Stella Ross-Craigs teckningar.

Måns Ryberg.

WARDLAW, C. W., Phylogeny and Morphogenesis. Contemporary Aspects of Botanical Science. — MacMillan & Co. London 1952. 536 sidor, 173 textfigurer. Pris 42 shillings.

1851 visade HOFMEISTER, att arkegoniaterna — mossor, ormbunkar — och de högre växterna — gymnospermer, angiospermer — ha en gemensam livscykel med generationsväxling. Hans upptäckter voro resultatet av ett förutsättningslöst studium av morfogenesen, individens utveckling; den forskningsinriktning, som HOFMEISTER företrädde, kan betecknas som allmän eller kausal morfologi. 1859 kom DARWINS »Origin of Species». Den speciella, jämförande morfologien, som syftar till att lämna bidrag till kännedomen om fylogenien, släktets utveckling, kom därefter att dominera. Ansamlandet av morfologiska och systematiska fakta fick en mening och ett bestämt mål, att bevisa evolutionen.

Halvseklet efter publicerandet av »Origin of Species» kan för den jämförande morfologiens del betecknas som den fyletiska perioden. Karakteristiskt är, att morfologi (med systematik och paleobotanik) och fysiologi under denna tid kommo att vandra skilda vägar, och att den utvecklingshistoriska forskningsriktningen fortsattes inom den senare vetenskapsgrenen. Nya, viktiga forskningsområden tillkommo, såsom cytologi och genetik.

Föreliggande arbete önskar stimulera till en omvärdering av fylogeniens betraktelsesätt med hjälp av den ökade kännedom om morfogenesen, som förvärvats inom de skilda specialvetenskaperna. WARDLAW anser nämligen, att komparationerna mellan olika grupper i många fall satts in för tidigt, innan de grundläggande morfogenetiska problemen blivit tillräckligt utforskade.

Boken omfattar 20 kapitel. I ett par av de första illustreras de fyletiska metoderna och resultaten med exempel från studiet av pteridofyterna, varvid fossila former särskilt beaktas. På DARWINS tid var uppställandet av ett stamträd för besläktade grupper evolutionsforskarens ideal. Men redan tämligen tidigt insåg man, att homoplastisk eller konvergent utveckling spelat en högst betydande roll både inom växt- och djurvärlden: från primitiva förfäder hade utveckling skett efter många parallella linjer. WARDLAW framhåller, att man kan tala om en fyletisk drift, en tendens till utveckling i viss riktning, som återkommer inom flera linjer, exemplifierad t. ex. i utvecklingen från eusporangiata till leptosporangiata former hos ormbunkarna under paleozoikum eller i tendensen till fröbildning hos olika grupper.

De allmänna fylogenetiska resultaten summeras i ett särskilt kapitel. På senare år övergick man alltmer till att betrakta de många grupperna inom växtriket som resultatet av polyfyletisk utveckling mer än strikt monofyletisk: »The family tree, in fact, had become a bush.» Som ett av samtidens förnämsta bidrag till den fylogenetiska diskussionen betraktar WARDLAW de cytogenetiska undersökningarna, där särskilt värdefulla synpunkter framgått ur MANTONS analys av kromosomtalen hos olika pteridofyter (1950).

Ett par speciella temata ägnas särskilda kapitel nämligen frågan om det bladbärande skottets ursprung och landvegetationens uppkomst. För-

fattaren diskuterar de megafylla och mikrofylla bladens ursprung samt telomteorien, som ju är rent fylogenetisk. Den därmed nära förknippade frågan om »The Origin of a Land Flora», transmigrationsproblemet, belyses med referat från arbeten av Bower, Church, Eames och Fritsch.

Efter en begreppsanalys av morfogenes och kausal morfologi kommer författaren in på de specialområden, som lämnat bidrag till kännedomen om utvecklingshistorien.

Genernas roll för morfogenesen behandlas utförligt i tre kapitel. Varje morfologisk karaktär är ju alltid betingad av många gener lika väl som av åtskilliga yttre faktorer; varje gen har dessutom i regel multipla effekter. Därtill kommer cytoplasmans roll. Genkontrollen torde huvudsakligen vara av biokemisk natur, men även fysiska faktorer spela in. Då kapitlen i mycket torde innehålla biologiskt allmängods, är ett utförligt refererat här ej på sin plats. Av intresse även för fylogenetikern är t.ex. förhållandet, att bestämda gener kontrollera form, och att dessa äro skilda från dem som bestämma storlek. Formen hos en frukt bestämmes sålunda genom att relativa tillväxten kontrolleras. Även i de utförliga referaten av hur kromosomfördubblingar påverka växtens allmänna livsduglighet och utveckling — de kunna ju stundom leda till avsevärda förskjutningar i livscykeln — finnes åtskilligt av allmänt intresse att hämta.

I ett särskilt kapitel behandlas möjligheterna att anlägga matematiska betraktelsesätt på materialet. För den ovannämnda relativa tillväxten har Julian Huxley uppställt en (empirisk) matematisk formel, den s.k. allometriska formeln. Anmärkningsvärt är, att skillnader i form hos olika grupper ofta på ett enkelt och slående sätt kunna demonstreras med deformerade koordinatsystem. Dylika matematiska metoder ha med framgång använts av d'Arcy Thompson, vars synpunkter utförligt refereras av förf.

De fysikaliska aspekterna på morfogenesen ägnas ett särskilt kapitel. Av avsevärd betydelse för bestämmandet av cellväggarnas läge är t.ex. ytspänningen, och det är felaktigt att med tidigare morfologer se jämförelsematerial av fylogenetiskt värde i snart sagt alla embryonala delningsstrukturer. Ökad storlek och därmed sammanhängande rent mekaniska faktorer ha visats spela en stor roll för stelens utformning, vilket i viss utsträckning har ändrat den fylogenetiska valören av vissa stelarkaraktärer.

De biokemiska processerna vid morfogenesen ägnas jämte den experimentella morfologien (förf.:s egen specialitet) stort utrymme; en koncentration av dessa avsnitt torde ha ökat bokens värde för icke-fysiologer. Den fundamentala betydelse meristemen ha för skottens utformning som säte för proteinsyntesen och hormonverksamheten belyses utförligt. Man får ett starkt intryck av den stora roll biokemiska hämningsmekanismer spela vid organbildningen; ett klassiskt exempel är ju hämningen av sidoskottens tillväxt genom auxin bildat i toppskottets apex. Morfogenesens natur belyses av förf. bl.a. med ett uttalande av Needham: »Development, then, consists of a progressive restriction of potencies by determination of parts to pursue fixed fates.»

Bland fysiologisk detaljinformation av intresse för den jämförande morfologen må t.ex. nämnas de fotoperiodiska förhållandenas betydelse för blad-

formen och utbildningen av blomskott. Författaren nämner på ett ställe, att kväve- och fosforbrist resultera i utbildningen av karaktärer, som äro typiska för xeromorfa växter. Man saknar dock ett omnämnande av det beaktansvärda förhållandet, att de övre bladen i ett skott äro mer xeromorfa än de lägre, en omständighet av visst intresse vid studiet av bladfossil.

De sista kapitlen behandla växternas allmänna organisation samt möjligheten till en syntes av resultaten inom de olika forskningsgrenarna. Enligt anmälarens mening illustrerar WARDLAWS bok snarast svårigheterna därvidlag. Dess värde ligger mera i de goda, och — såvitt undertecknad kan bedöma — vederhäftiga översikter den ger över aktuella områden inom botaniken, än som ett incitament till en allmän omvärdering av de fylogenetiska arbetsmetoderna. Men trots allt ger oss WARDLAWS arbete många värdefulla tankeställare. Fylogenien önskar registrera genotypens förändringar, och vare sig det gäller arbete med recenta eller fossila växter, bör man ihågkomma att den endast har fenotypen till förfogande som arbetsmaterial.

Britta Lundblad.

OVERHOLTS, L. O. (†), The *Polyporaceae* of the United States, Alaska and Canada. Prepared for publication by J. L. LOWE. — University of Michigan Studies, Scientific Series Vol. 19. Ann Arbor (University of Michigan Press) 1953. — 466 sidor och 132 pl. med bortemot 700 fig. — Pris 7: 50 $.

LEE ORAS OVERHOLTS (1890—1946) åtnjöt under en följd av år anseende som en av de främsta kännarna (kanske den allra främste) av Nordamerikas polyporaceer. Vid hans död förelåg ett praktiskt taget färdigt manuskript över de nordamerikanska representanterna av *Polyporaceae* i gammal (Friesisk) bemärkelse (med uteslutande av släktena *Merulius* och *Poria*). Vissa tillägg äro gjorda av LOWE och särskilt markerade. Manuskriptet påbörjades redan 1933, ända till sin död arbetade O. därmed och höll det någorlunda up-to-date. För studiet av nordamerikanska polyporaceer, av vilka 235 arter och 12 varieteter beskrivas, blir arbetet den oumbärliga handboken. Då flertalet europeiska arter även växa i Nordamerika, kommer det förvisso att bli flitigt använt även i Europa, icke minst på grund av uppgifterna om utbredningar och substrat samt av det överflödande rika illustrationsmaterialet.

Förf. har föredragit att ge familjen sitt gamla traditionella omfång och att fördela de behandlade arterna på de åtta släktena *Fomes* (40 arter + 6 diskutabla), *Lenzites* (5 arter), *Cyclomyces* (1 art), *Daedalea* (7 + 1 arter), *Hexagona* (1 art), *Trametes* (13 + 4 arter), *Favolus* (6 arter) och *Polyporus* (162 + 29 arter); släktena inledas med utförliga examinationsschemata. Det är givetvis praktiskt att i en flora av detta omfång vara konservativ i fråga om familje- och släktbegränsningar. När det gäller en familj sådan som den traditionella *Polyporaceae*, blir ett sådant handlingssätt nära nog en naturnödvändighet, ty i den omvälvning de aphyllophorala hymenomyceternas systematik genomgår, står f.n. blott så mycket fullt klart som

att porsvamparna i framtidens system ej komma att bilda en egen avdelning och att de naturliga grupperna komma att bli karakteriserade av helt andra egenskaper än fruktskiktets konfiguration. Hur grupperna i detalj komma att bli utformade och diagnosticerade, är däremot alltjämt höljt i dunkel. Säkert är att även släktomgränsningarna komma att förändras lika radikalt, men ej heller här kunna några definitiva lösningar ännu skönjas. Det verkar nära nog som om de flesta forskare på området ansåge sig av självaktning förpliktade att introducera ett eget system. Bortser man emellertid från skiljaktiga meningar om gruppers taxonomiska rang och släktnomenklatur, så kan en utomstående betraktare emellertid konstatera att det råder en tämligen allmän enighet om naturligheten av talrika artgrupperingar. Det är stor skada, att förf. ej gjort något allvarligt försök att sammanföra arter till naturliga grupper och att citera som synonymer åtminstone några av de släktnamn, som brukas av den Patouillard'ska skolans anhängare. Synonymiken är överhuvud mycket sparsam och hänför sig egentligen blott till amerikanska förhållanden, därför äro alla Murrill's nykombinationer omsorgsfullt beaktade. Arbetet har otvivelaktigt mycket stora förtjänster som deskriptiv flora och fyller en stor och mycket kännbar lucka i den mykologiska litteraturen. Ur allmännare synpunkter måste man dock beklaga, att arbetet redan vid utgivandet gör ett ganska föråldrat intryck. Det betecknar snarare avslutningen på en epok än inledningen till en ny.

John Axel Nannfeldt.

John Gilmour and Max Walters, Wild Flowers. Botanising in Britain. — The New Naturalist. London (Collins) 1954. XIV + 242 s., 32 pl. i färg och 24 pl. i svart-vitt. Pris 25 s.

»Det första steget mot att bli en fältbotanist är att bli gripen av en oemotståndlig passion.» Med dessa ord inleder John Gilmour ett av kapitlen i ovanstående arbete. Men det räcker icke med att lågan blivit tänd, den måste också underhållas, och det är i denna avsikt, som boken blivit skriven.

Att författa en handledning i fältbotanik för amatörer är utan tvivel en tacksam uppgift. Entusiasmen är nybörjarens främsta tillgång; det gäller nu att så att säga kanalisera den i lämpliga fåror. Mycket hängivet arbete blir ofta bortkastat för att vederbörande icke iakttagit vissa enkla regler, t. ex. betr. etikettering. Och den så ofta osparda mödan skulle förvisso bära rikare frukt, om den planmässigt länkades in på aktuella forskningsuppgifter.

Bokens titel gör knappast rättvisa åt dess mångsidiga innehåll. Här får läsaren icke blott värdefulla råd angående exkursionsteknik, samlarverksamhet och litteraturstudier utan även en populärt hållen översikt av landets flora, grupperad efter de viktigaste ståndortstyperna. Denna översikt intar huvuddelen av arbetet och är avsedd att bilda en inledning till den mera avancerade framställning, som ges i Turrills »British Plant Life» i samma serie (jfr rec. i Sv. Bot. Tidskr., 43, s. 132). Den brittiska florans

invandringshistoria får ett eget kapitel, likaså upptäcktshistorien. Några moderna utvecklingslinjer inom systematik och växtgeografi behandlas i all korthet.

Arbetets förträffliga illustrationsmaterial förtjänar ett särskilt omnämnande. Många av bilderna i färg och svart-vitt äro riktiga njutningar för ögat, så t. ex. *Eranthis hiemalis* på pl. 7 och ljungheden på pl. 11, mycket annat att förtiga. Den förnämliga utstyrseln och den medryckande framställningen över en flora, som vår egen har så mycket gemensamt med, göra arbetet väl värt att uppmärksammas även i vårt land.

Sten Ahlner.

Svensk Botanisk Tidskrift. Bd 48, H. 3. 1954.

FLORAN I NORDÖSTRA DELEN AV SJUHÄRADSBYGDEN

AV

G. A. WESTFELDT.

1. Huvudproblem och geografisk översikt.

Det är sedan gammalt känt, att våra kontinentala arter ha sin västsvenska högborg i trakterna kring Billingen och Falbygdens berg. Stäppfloran på *Stipa*-kullarna i Dala, Vartofta Åsaka och Näs ha under de sista åren i samband med komminister Lennart Fridéns vackra fynd av fjädergräset i den sistnämnda socknen på nytt kommit i rampljuset. Det är dock ej blott *Stipa* som intresserar, även om hon är pärlan i det växtsamhälle, det här är fråga om. *Stipa*'s följeväxter på moränåsarna i Syd-Falans kame-landskap, *Prunella grandiflora*, *Seseli libanotis* o.a. väcka även de i hög grad vår uppmärksamhet.

Sedan jag haft den glädjen att sommaren 1947 med Fridén som ciceron på ort och ställe beundra »drottningen i Näs» (*Stipa pennata*) och senare under denna sommar givits tillfälle beskåda den nordliga myrbräckan och den kalkfordrande vippstarren på gungflyn i Sjöängen i Slöta, inställde sig för mig följande fråga: Var går i Västergötland sydgränsen för alla dessa Falbygdens rariteter, *Galium triandrum* och *Dracocephalum ruyschiana*, de kalkgynnade orkideerna och våra glaciala relikter? Ja, det var ett intressant spörsmål, väl värt att offra några somrars fritid på.

Sedan tidigare år var jag förtrogen med floran i Ås och södra och mellersta delarna av Redvägs härader. Det gällde nu alltså att även undersöka norra Redväg, övergångsområdet till Falbygden. Allt eftersom undersökningarna fortskredo, visade det sig nödvändigt att utvidga verksamhetsfältet söderöver till norra Kind, varigenom bygderna kring sjöarna Åsunden och Tolken i sin helhet kommo att falla inom mitt undersökningsområde. Självfallet har hela detta område, cirka 2000 km², blivit högst olika undersökt. De redovisade

lokalerna äro från Redväg och Ås avsevärt flera än från Kind, och analogt förhåller det sig med antalet uppgifter från Viskans och Ätrans dalgångar gentemot dem från skogssocknarna på gränsen till Småland. Mycket återstår ännu att göra för att få fram en minutiös lokalförteckning för området, men det är att hoppas, att denna uppsats skall ge en någorlunda god bild av floran inom den nordöstra fjärdedelen av Sjuhäradsbygden.

Undersökningsområdet är högländ och starkt kuperat. Höga åsryggar, vanligen orienterade i norr och söder och merendels klädda med barrskog omväxla med djupa dalgångar, som inom vissa delar av Ätradalen begränsas av branta stup. Höjdaxeln, som löper i ost—västlig riktning, övertvärar bygden vid norra delen av Tolken och Åsunden och kulminerar i Galtåsen, 1 mil Ö om Ulricehamn (358 m ö. h.). Norrut övergår landskapet successivt i Falbygdens högslätt och söderöver i Kinds härads av vidsträckta skogs- och mossmarker uppfyllda platålandskap.

Geologiskt sett vilar området helt på urbergsgrund, även om blott några kilometer skilja dess nordligaste socken, Smula, från sandstenens sydkant söder om Ålleberg. Urberget, som ingenstädes i någon större utsträckning går i dagen, utgöres till övervägande del av järngnejs, som på några ställen, särskilt väster om Åsunden, genomdrages av smärre i ost—väst orienterade dioritstråk. Dessa stråk tyckas märkvärdigt nog på ett undantag när, Kråkeboberg (Westfeldt 1947), utöva ett förvånansvärt ringa inflytande på floran. Större delen av området täcks av ett tunt, rikblockigt moränskikt, som i dalbottnarna, speciellt kring Åsunden och i övre Viskadalen, ersättes av svämsand, ofta vilande på insjöleror. De lösa jordarterna äga som regel en relativt hög kalkhalt, särskilt norröver. Det är växlingen i kalkhalt, som är orsaken till florans olika sammansättning inom skilda delar av området. Under det att de kalkgynnade elementen dominera i Redväg och Ås, överväga oligotrofa arter inom de södra, enkannerligen de sydostliga socknarna.

Av mera betydande rullstensåsar märks i första hand Ulricehamnsåsen, som från Vartofta härad på Falbygden sträcker sig med två ryggar in i Redväg. Från N. Åsarps kyrka löper åsen parallellt med Ätran som en väl markerad rygg, som dessvärre i våra dagar på flera ställen hårt utnyttjats för grustäkt. I Blidsberg och Dalum upplöses åsen i ett antal ± fristående kullar för att slutligen försvinna under dalbottnens svämsand. S om Åsunden ger sig Ulricehamnsåsen åter till känna i Tvärreds och Länghems socknar, men ej som en

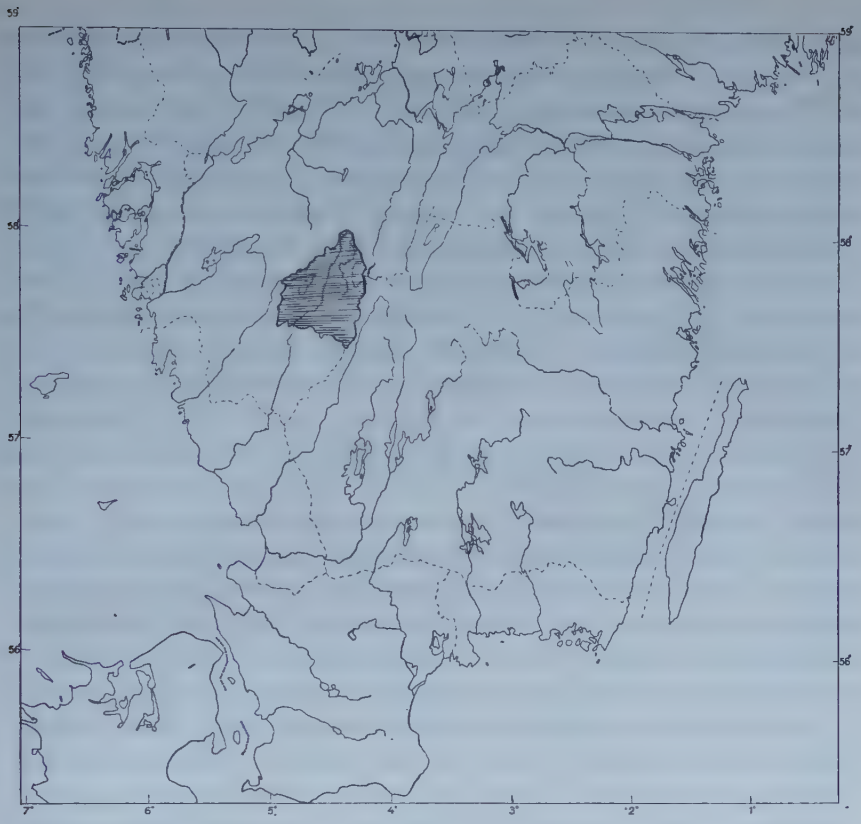

Fig. 1. Undersökningsområdets läge och omfattning.

rygg utan i form av ett relativt jämnt grusplan. Ö om den egentliga Ätradalen löper Hössnaåsen parallellt med Ulricehamnsåsen genom övre Ätradalen, Hössnadalen, som jag i det följande kommer att kalla den. Sistnämnda ås ger sig nordligast tillkänna i Solberga, där den såväl N som S om kyrkan är utbildad som en vacker rygg. Sin största mäktighet når ifrågavarande ås i Hössna socken. Ås härad äger egentligen blott en rullstensås av betydelse, Rångedalaåsen, som når en imponerande mäktighet i Rångedala och Toarp, där det aldrig sinande grusbehovet tyvärr åstadkommit fula sår.

2. Områdets utforskningshistoria.

Den botaniska litteraturen är fattig på uppgifter från Ulricehamnstrakten och häraderna däromkring. Den äldsta publikation, som be-

handlar denna del av Västergötland, är A. Winboms doktorsavhandling, »Dissertatio de Ulricaehamn» 1782. Winbom var ej botanist. Den floristiska delen är uppgjord av med. kand. D. E. Naezén, och förteckningen baserar sig på dennes egna iakttagelser under en resa i trakten 1780. Vid en jämförelse mellan Naezéns fynd och ortens nutida flora förefaller det som om han i huvudsak exkurrerat kring Åsundens norra del, passerat sankmarkerna vid Ätrans utlopp i sjön och vidare västerut förbi nuvarande begravningsplatsen till Åsakullen och möjligen även Kråkeboberg. Tyvärr saknas hos Naezén närmare lokaluppgifter, varför man ej kan fastslå i vilken socken de olika fynden äro gjorda. Senare författare som Aug. Rudberg ha följaktligen hänfört samtliga Naezéns uppgifter till Ulricehamn. 1897 publicerade Rudberg några spridda botaniska iakttagelser från Västergötland, vilka återfinnas i hans år 1902 utgivna »Förteckning öfver Västergötlands fanerogamer och kärlkryptogamer». Detta arbete är det enda sammanfattande, som vi äga om floran i Västergötland. Tyvärr lämnar Rudberg inga uppgifter om, vem som gjort de olika fynden, ej heller när de blivit gjorda, vilket skulle ha varit synnerligen värdefullt ej minst ur den synpunkten, att man då haft en värdemätare på hur pass tillförlitliga uppgifterna äro. Förutom en del klart dubiösa lokaler meddelar Rudberg några alltför diffusa. Sålunda uppger han *Dracocephalum ruyschiana* och *Carex flacca* o. a. för rätt och slätt Ätran. Längs sagda flods 10 mil långa lopp från Skaraborgs läns gräns till Halland ha ifrågavarande arter blott anträffats norr om Åsunden, varför uppgifterna måste betecknas som vilseledande.

Från 1928 daterar sig Gunnar Kjellbergs »Kärlväxternas ståndorter och utbredning i Västergötland». I denna på lokaler, särskilt beträffande allmännare arter, så rika publikation har författaren dessvärre okritiskt tagit med en del osäkra uppgifter, varjämte han dragit några förhastade växtgeografiska slutsatser. Det vackra fyndet av *Cypripedium calceolus* från »Ulricehamn (St. Skottek)» är tyvärr alltför gott för att vara sant. Uppgiften har, enligt vad jag erfarit, lämnats av läroverksadjunkt Folke Persson (Karlstad), som i sin tur fått den av en skolpojke. I den växtgeografiska inledningen sammanför Kjellberg Svältorna med det kalkrika moränlandskapet söder om Falbygden till något, som han kallar »övergångsområdet», och som utmärkande för detsamma anför han »vissa glaciala relikter: *Pedicularis Sceptrum Carolinum, Saxifraga Hirculus, Saussurea alpina*». Valet av karaktärsväxter må tala för sig självt. *Saxifraga*

hirculus ansågs dock som utdöd i Västergötland vid ifrågavarande tidpunkt och återupptäcktes av Fridén först 1946. *Pedicularis sceptrum-carolinum* hör till landskapets stora sällsyntheter, och vad *Saussurea* beträffar var 1928 ännu ingen lokal känd för denna art från Kjellbergs övergångsområde. Från 1920-talets första år föreligga R. Sterners och F. Hård av Segerstads växtgeografiska gradualavhandlingar med deras rikhaltiga material av prickkartor samt Hugo Osvalds monografi över Komosse. Slutligen ha vi Sandberg & Söderbergs »Boråstraktens flora» (1922). Från mina egna undersökningar, som togo sin början 1920, har material publicerats vid olika tillfällen (jfr litteraturförteckningen).

3. De suboceaniska arterna.

Vid granskning av Naezéns artlista (Winbom 1782) finner man, att åtskilliga arter, som där uppgivas, numera saknas i Ulricehamnstrakten. Det råder ingen tvekan om att bygden kring Åsundens nordända undergått stora förändringar genom 1800-talets sjösänkningar. Personligen har jag understundom liknat nyssnämnda sjö, där den ligger inramad mellan höjderna, vid en havsfjord, och med tanke på Naezéns fynd blir denna bild än mer träffande. *Armeria maritima, Cornus sanguinea, Lonicera periclymenum, Ophioglossum* och *Sedum rupestre,* som samtliga äro utgångna, torde i nutiden knappast förekomma tillsammans vid någon insjö så långt från havet. Alla med undantag för *Ophioglossum* växa i våra dagar på andra punkter i det inre av södra Västergötland. Mera skeptisk ställer man sig då mot uppgifterna om *Echinodorus ranunculoides* och *Thalictrum minus.* Den *Thalictrum*-art, som Naezén betecknar som *minus,* har med all säkerhet varit en form av *Th. simplex,* som varierar åtskilligt och som ju är ganska vanlig i trakten, där den uppträder såväl i de kontinentala örtbackarna som på fuktig mark. Rudberg uppger *Th. minus* förutom från Ulricehamn, vilken lokal han tydligen lånat från Naezén, jämväl från N. Åsarp, en uppgift, som måste avfärdas av samma skäl som den föregående. Än mer kritisk ställer jag mig mot uppgiften om *Echinodorus ranunculoides.*

Utöver de nämnda arterna uppger Naezén *Gentiana pneumonanthe* och *Radiola* från Ulricehamn. Den förstnämnda har 1953 blivit återfunnen av en skolflicka i Vist några kilometer N om Åsunden. Eljest har arten endast påträffats på några punkter inom områdets södra och västra socknar. *Radiola,* som har några spridda förekomster

inom området, har däremot ej återfunnits vid Åsunden i senare tid. Utöver de nämnda uppger Rudberg *Centunculus* för Ulricehamn. Uppgiften baserar sig säkerligen på ett ark i lundaherbariet, insamlat 1874 av E. Ährling. Under innevarande sekel har arten ej blivit sedd.

Härutöver förekomma inom området en del suboceaniska arter, som saknas hos Naezén. Några av dessa äro ± vanliga i de sydvästliga socknarna för att avta i frekvens mot nordost, mot Ulricehamnstrakten och Falbygden. Flera nå f. ö. sin nordgräns eller rättare nordostgräns inom mitt område, ehuru de äga några spridda lokaler längre österut. *Sagina subulata, Scirpus caespitosus* ssp. *germanicus* och *S. multicaulis* ha sålunda sina enda förekomster i Toarp och Ljushult, och *Teesdalia* fann jag 1952 i Länghem. Förutom *Gentiana pneumonanthe* nå även *Hydrocotyle* och *Pilularia* Hillared och Sexdrega. Den förra växer flerstädes på sjö- och bäckstränder i Såkens vattensystem samt utmed Ätran i Sexdrega, där även *Pilularia* har några sparsamma förekomster. Den senare uppges av kontraktsprosten N. J. Nordholm från Strängseredsjön i östra Redväg, ett fynd som senare bekräftats av lektor Carl Bliding (Borås). *Galium hercynicum* och *Hypochoeris radicata* nå fram till socknarna strax V om Ätradalen. I ungefärligen samma trakt ha *Silene rupestris* och *Quercus petraea* sina östligaste utposter inom landskapet. Bergeken, som förekommer här och var inom de sydvästliga socknarna, växer i några bergsstup vid Åsunden. Korsningen mellan våra båda ekarter är även funnen inom området. Den är dock sällsyntare än *Quercus petraea*. Östligast växer den i Timmele ½ mil N om Åsunden. Intressant är även utbredningen av *Mercurialis perennis* i södra Västergötland. Dess lokaler äro i hög grad koncentrerade till Viskans dalgång samt trakterna kring Tolken och Åsunden, där arten på sina håll är vanlig. Däremot tycks den i likhet med en del andra lundväxter saknas i Ätrans dalgång S om sistnämnda sjö.

Erica, Juncus squarrosus, Littorella, Pedicularis silvatica och *Polygonatum verticillatum* ha stor utbredning inom området, medan *Blechnum* och *Leucorchis* äro sparsamt företrädda. Den senare återfinner man f. ö. sällan på äldre fyndorter. Vi ha slutligen *Narthecium*, som förutom på några lokaler i söder och sydväst jämväl förekommer inom ett begränsat område kring Komosse vid smålandsgränsen samt på Galtåsen.

Boken, som enligt tillgängliga handlingar måste ha varit allmän inom stora delar av södra Västergötland i äldre tider, då den tillika

med eken var det egentliga skogsträdet, finner man numera sällan beståndsbildande. I våra dagar växer trädet ganska allmänt inom ett större område inom Brunns, Tvärreds, Dannike, Ljushults, Äspereds och Toarps socknar V om Åsunden. Förutom smärre dungar finner man enstaka ungbokar i barrblandskogen, vilket tyder på att trädets återväxt är god samt att det är statt på frammarsch. Det var inom detta bokskogsområde, som de gamla skålknallarna hämtade råmaterialet till sin träslöjd. Trädets nordostgräns skär genom bygden på en linje Grovare–S. Ving–Brunn–Grönahög. Det renaste och vackraste beståndet växer vid Stenshult i Dannike. Det utgöres av en sluten dunge omfattande cirka 16 har med 100-åriga, rakstammiga träd och tillhör hedskogstypen. Den naturliga föryngringen är god, såväl inom beståndet som i grannskapet. Egentligt buskskikt saknas, men i de öppnare partierna förekommer sparsamt med hallon. Även fältskiktet är svagt utbildat och domineras av *Anemone nemorosa, Oxalis* och *Lastrea dryopteris*. Eljest ingå i detsamma *Deschampsia flexuosa, Dryopteris austriaca* och *filix-mas, Festuca ovina, Lastrea phegopteris, Luzula pilosa, Potentilla erecta, Solidago virgaurea, Trientalis, Vaccinium myrtillus, Veronica officinalis* och *Viola riviniana* jämte några större mattor av *Lycopodium annotinum* och i dungens södra del ett nästan rent bestånd av *Maianthemum bifolium*, som täcker en yta av cirka 10 kvm.

För omkring 20 år sedan fann Martin Svensson (Borås) *Hedera helix* i Roasjö, 2 mil SV om Åsunden. Murgrönan växer här i en sydsluttning 180 m ö.h. omedelbart N om en mindre mosse och i en utpräglat oligotrof omgivning. Sluttningen täcks av björk—granskog med undervegetation av blåbär, ljung och lingon. *Hedera*, som eljest i Sjuhäradsbygden är känd endast från gränssocknarna mot Halland, växer i Roasjö huvudsakligast på marken. Vid mitt första besök på platsen den 5/4 1936 hade ett fertilt skott nått upp till 4 m höjd i en medelålders sälg (*Salix caprea*), och ett par grenar buro halvmogna bär. Då jag några år senare efter 1940-talets hårda vintrar på nytt besökte platsen, var murgrönan nedfrusen och återfanns endast utmed markytan, men unga skott strävade på nytt uppför sälgstammen.

Även tvenne i Sverige mest såsom brackvattensarter uppträdande växter äro funna i bygden, *Potamogeton filiformis* och *pectinatus*. Den senare uppgives hos Holmberg (1922) för Åsunden. Till grund för denna uppgift ligger säkerligen ett ark i Riksmuseets samlingar insamlat 1846. Jag har själv förgäves sökt växten i Åsunden under

senare år. *Potamogeton filiformis* är funnen av Hasselrot i Viesjön och Bredsjön på gränsen mellan Redväg och Ås. I Viesjön förekommer arten dels på grunt vatten ute i själva sjön, dels i några smärre gölar innanför den östra strandkanten, där den vid mitt besök 1952 uppträdde i sällskap med *Chara contraria*.[1]

Lindblom (1843) uppgiver, att »stud. O. Hammar ... utom andra vexter samlat ... *Capsella petraea* Fr. [*Hornungia*] på Vistberget nära Ulricehamn, i hvilken trakt han äfven säger sig hafva funnit *Arenaria gothica* Fr.». Båda uppgifterna återfinnas hos Rudberg. Beträffande *Arenaria gothica* är Rudberg dock tveksam, ty i en not anmärker han »ug.: Ulricehamn, ej bekräftad», vilket man knappast behöver förvåna sig över. Beläggexemplar saknas i våra offentliga herbarier och uppgiften måste, som Albertson (1946) påpekar, betecknas som »högst dubiös». Framlidne A. O. Olson meddelade mig vid ett tillfälle, att han under yngre dagar skulle ha sett *Hornungia* »på ett stort block nedom stupet i Vistberget». Hur mycken tilltro man får sätta till denna uppgift, vet jag ej. Våren 1948 gjorde jag en iakttagelse, som möjligen kan ge en förklaring till gåtan. Jag fann då i den övre delen av rasmarken några groddplantor av *Cardamine impatiens*, som vid detta tidiga datum (18 mars) i någon mån erinrade om *Hornungia*. Har Hammar möjligen kunnat förväxla dessa båda arter?

4. Stäppfloran.

Med stäppväxter avser jag de utpräglat kontinentala arter, som äro hemmahörande på öppna torra ståndorter. De ha i regel en sydlig eller sydostlig utbredning i Europa. På Syd-Falan är detta element rikast företrätt på kame-landskapets åsryggar (Fridén 1948). I Redväg finner man dess representanter dels på torra mot SO exponerade rullstensåsar, dels på ± fristående moränkullar, vanligen ingående i växtsamhällen, som äro starkt kulturpåverkade och som endast tack vare betningen och ängsslåttern kunnat bibehålla sin öppna karaktär under seklernas lopp.

Vid L. Fagerhult i Smula, alldeles inpå gränsen till Skaraborgs län, stöter man på den första åsen med stäppvegetation. Fagerhultsåsens sällsyntaste art är *Galium triandrum*, som blott är iakttagen på ytterligare tre lokaler i Sjuhäradsbygden, vid Kolbrandstorp och på »Smula åsar» i Smula samt vid Hansagården i N. Åsarp.

[1] Bredsjölokalen, som upptäcktes så sent som 1954, löper på grund av den pågående sjösänkningen dessvärre allvarlig risk att förintas.

I sistnämnda socken finner man V och SV om järnvägsstationen en del moränkullar med stäppväxter. Rikast utbildad är floran på en torr, relativt brant och med en talldunge krönt kulle N om Alvared. Här saknas visserligen *Galium triandrum*, men i stället frapperas man av de vackra bestånden av *Dracocephalum ruyschiana*. På kullens sluttningar växa några spridda exemplar av rönn samt en, under det att fältskiktet utgöres av *Achillea millefolium*, *Agrostis canina*, *Alchemilla* spec., *Anemone pulsatilla*, *Antennaria dioeca*, *Anthyllis*, *Arenaria serpyllifolia*, *Artemisia campestris*, *Avena pratensis*, *Briza*, *Campanula rotundifolia*, *Carex caryophyllea* och *ericetorum*, *Centaurea scabiosa*, *Chrysanthemum leucanthemum*, *Dactylis*, *Deschampsia flexuosa*, *Dianthus deltoides*, *Festuca ovina*, *Filipendula vulgaris*, *Fragaria viridis*, *Galium boreale* och *verum*, *Geranium sanguineum*, *Hieracium pilosella* och *umbellatum*, *Hypericum maculatum*, *Lathyrus montanus*, *Lotus corniculatus*, *Phleum phleoides*, *Plantago lanceolata*, *Poa pratensis*, *Polygala vulgaris*, *Polygonatum odoratum*, *Potentilla Tabernaemontani*, *Primula veris*, *Ranunculus polyanthemus*, *Rumex acetosella*, *Saxifraga granulata*, *Silene nutans*, *Solidago virgaurea*, *Succisa pratensis*, *Trifolium medium* och *montanum*, *Veronica chamaedrys* och *Vicia cracca*.

Rikt utbildad är stäppvegetationen jämväl inom vissa partier av den flera kilometer långa åsen mellan N. Åsarps kyrka och Sverkilstorp i Kölaby. Inom ifrågavarande åspartis nordligaste del vid avtagsvägen till Solberga (pkt 222,4 på generalstabsbladet) finns ett mindre åsgropsparti, som är bevuxet med ett 50-årigt, tätt slutet granbestånd med en ytterligt trivial undervegetation. Inom områdets perifera delar varsla dock en del stäppväxter, *Brachypodium pinnatum*, *Fragaria viridis*, *Potentilla rupestris*, *Pulmonaria angustifolia* samt *Salix depressa* om, att detta åsgropsparti tidigare, innan barrskogsplanteringen ägt rum, hyst en intressant flora.

Förflyttar man sig ytterligare ½ mil söderöver, äro stäppväxterna rikligt representerade inom åsområdet S om Trädets samhälle samt på de torra backsluttningarna och rullstensåsarna Ö om Humla kyrka.

Ytterligare ett åsgropsparti, de s.k. baktrågen, finns vid Kässeberg i Blidsberg. Sagda område utgöres av ett konglomerat av åskullar och åsgropar täckt av lövskog av alm, ask, björk och ek och med ett buskskikt, som domineras av hassel med inblandning av *Lonicera xylosteum*, *Rhamnus catharticus* och *Viburnum*. De öppna ängsmarkerna i baktrågens botten, som tidigare odlats, domineras av

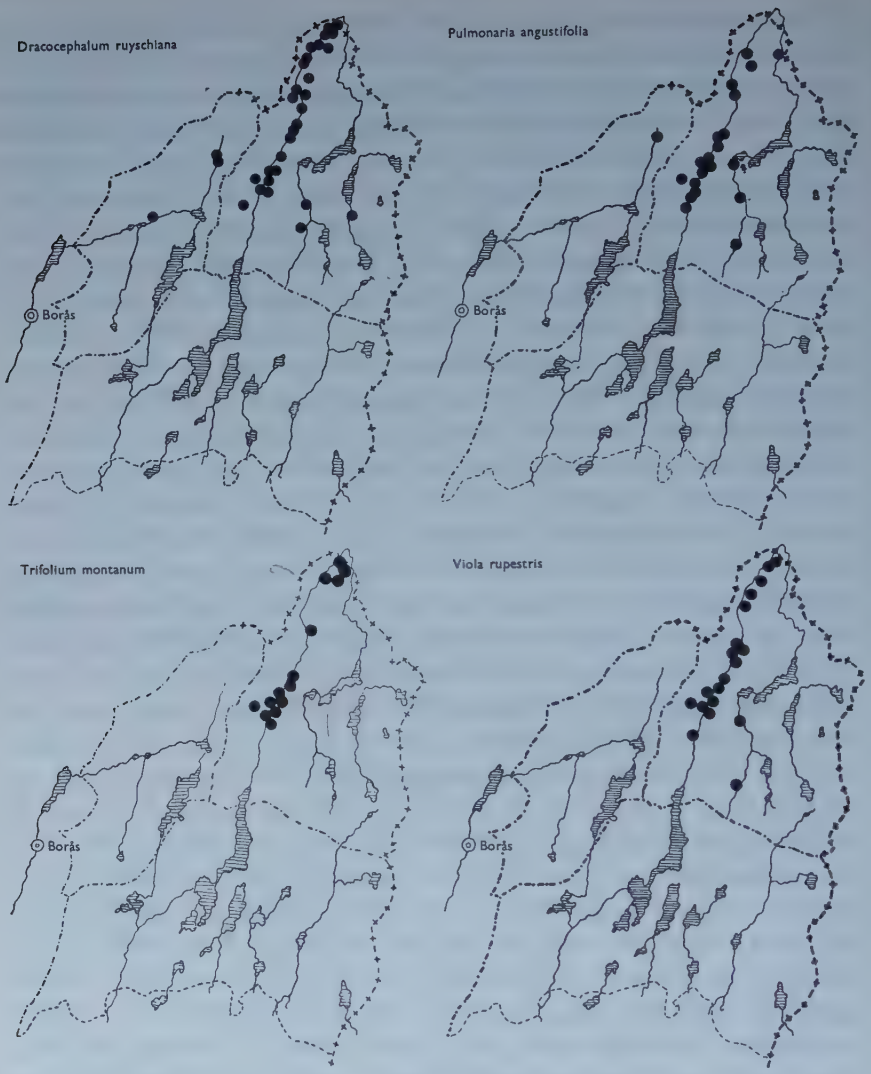

Fig. 2. Utbredningen inom undersökningsområdet av *Dracocephalum ruyschiana*, *Pulmonaria angustifolia*, *Trifolium montanum* och *Viola rupestris*.

Trollius. I hässlena växer en egendomlig blandning av lundväxter och representanter för de öppna, torra örtbackarna. Till de förra höra *Actaea*, *Adoxa*, *Allium oleraceum*, *Anemone hepatica*, *Campanula trachelium*, *Cardamine impatiens*, *Carex montana*, *Gagea lutea*, *Paris*, *Polygonatum verticillatum*, *Vicia silvatica*, *Viola mirabilis*, till de senare *Arabis hirsuta*, *Astragalus glycyphyllus*, *Crepis praemorsa*, *Fili-*

pendula vulgaris, Fragaria viridis, Geranium sanguineum, Polygonatum odoratum, Potentilla rupestris och *Tabernaemontani, Primula veris, Ranunculus polyanthemus, Thalictrum simplex, Viola hirta* samt bygdens kanske vackraste och exklusivaste vårblomster, *Pulmonaria angustifolia.*

Några hundra meter N om den gamla bron vid Dalums kyrka ligger strax Ö om Ätran på Svenstorps ägor en flack moränkulle med ett trädskikt av asp, björk och ek. I buskskiktet ingå en, gran, hallon, hassel, hägg, krusbär, *Rhamnus catharticus, Ribes rubrum* (*pubescens*) samt *Salix caprea, cinerea* och *depressa* och i fältskiktet *Alchemilla glaucescens, Allium oleraceum, Anemone nemorosa, Angelica, Anthoxanthum, Anthriscus silvestris, Arabis hirsuta, Astragalus glycyphyllus, Avena pratensis, Brachypodium pinnatum, Campanula persicifolia, Carex montana, Chamaenerion, Convallaria majalis, Crepis praemorsa, Dactylis, Dryopteris filix-mas, Festuca ovina, Filipendula vulgaris, Fragaria vesca, Galium boreale* och *verum, Geranium silvaticum, Heracleum sphondylium* ssp. *sibiricum, Lathyrus heterophyllus* och *pratensis, Luzula campestris* och *pilosa, Melampyrum pratense, Paris, Potentilla erecta* och *rupestris, Primula veris, Pulmonaria angustifolia, Pyrola rotundifolia, Rubus saxatilis, Rumex acetosa, Satureja acinos, Scorzonera, Scrophularia nodosa, Solidago virgaurea, Succisa pratensis, Taraxacum* spec., *Trifolium medium, Trollius, Valeriana sambucifolia, Veronica chamaedrys, Vicia cracca, Viola canina* och *hirta.*

Intressant är även vegetationen inom ett parti av åsbrinken strax NV om Krutbrännaregården i Dalum. Tack vare jordflytningen och kreatursstigarna är växttäcket ej helt slutet. Inom vissa delar dominerar gråal men dessutom uppträda asp och hägg samt smärre, enstaka exemplar av ek, tall, gran och *Prunus avium.* I buskskiktet förekomma manshöga exemplar av *Lonicera xylosteum,* vidare hallon, krusbär och någon enstaka *Rhamnus catharticus.* I fältskiktet ingå *Achillea ptarmica, Anemone pulsatilla, Arabidopsis, Arabis hirsuta, Artemisia campestris, Calamagrostis epigeios, Capsella, Centaurea scabiosa, Cerastium arvense* och *semidecandrum, Crepis praemorsa, Dactylis glomerata, Draba verna, Equisetum arvense, Festuca ovina, Filipendula vulgaris, Fragaria vesca, Galium verum, Heracleum sphondylium* ssp. *sibiricum, Hieracium pilosella, Hypericum perforatum, Hypochoeris maculata, Moehringia, Phleum phleoides, Pimpinella saxifraga, Potentilla Crantzii, rupestris* och *Tabernaemontani, Primula veris, Prunella vulgaris, Pulmonaria angustifolia, Ranunculus polyanthemus, Satureja acinos, Saxifraga tridactylites, Scabiosa colum-*

baria, Scleranthus perennis, Sedum annuum och *telephium, Silene nutans, Solidago virgaurea, Taraxacum* spec., *Thymus serpyllum, Turritis, Vicia cracca, Viola arvensis, hirta* och *rupestris.*

Men det är ej blott på fristående kullar och åsar samt i brinkarna längs Ätran, som man finner stäppflorans representanter. De förekomma även högre upp på dalsluttningarna och då gärna kring odlingsrösena ute i åkrarna. En liten moränkulle strax V om landsvägen nedom Silarp i Dalum hyser sålunda Sjuhäradsbygdens vackraste kontinentala växtsamhälle med vårt lands måhända rikaste *Dracocephalum ruyschiana*-förekomst. Under det att kullens södra hälft täcks av en uppväxande lövskog med bl. a. gråal, asp och *Salix depressa,* utgöres den norra delen av öppen ängsmark med meterhöga enbuskar. I fältskiktet finner man bl. a. *Anemone nemorosa, Arnica montana, Artemisia campestris, Avena pratensis, Calluna, Carex montana, Convallaria majalis, Filipendula vulgaris, Galium boreale* och *verum, Geranium silvaticum, Hieracium umbellatum, Hypochoeris maculata, Lathyrus montanus, Phleum phleoides, Pimpinella saxifraga, Plantago media, Polygonatum odoratum, Potentilla Crantzii* och *rupestris, Primula veris, Pulmonaria angustifolia, Ranunculus polyanthemus, Rubus saxatilis, Scorzonera, Solidago virgaurea, Thymus serpyllum, Trifolium montanum, Viola canina* och *Viola canina* × *stagnina.*

Pulmonaria angustifolia's sydligaste förekomst i den egentliga Ätradalen finner man vid Kattåkra i Timmele. I en torr mot S vettande ekbacke, en degenererad löväng av hagmarkstyp, växa spridda individ av *Pulmonaria,* merendels tätt tryckta intill enbuskarna. Något egentligt buskskikt existerar ej, men granen vinner snabbt terräng, och vegetationen är avsevärt trivialare än på artens övriga ståndorter. Här finner man sålunda *Alchemilla* spec., *Anemone nemorosa, Antennaria dioeca, Anthoxanthum, Calluna, Campanula persicifolia* och *rotundifolia, Carex montana* och *pilulifera, Festuca ovina, Fragaria vesca, Geranium silvaticum, Hieracium pilosella, Lathyrus montanus, Luzula campestris, Melampyrum silvaticum, Plantago lanceolata, Primula veris, Rumex acetosa, Succisa pratensis, Thymus serpyllum, Veronica chamaedrys, Vicia cracca, Viola canina* samt blåbär och lingon. I markskiktet förhärskar *Hylocomium splendens.*

Några moränbackar S om Marbäcks kyrka äga Ätradalens sydligaste stäppvegetation. I densamma ingå *Fragaria viridis, Geranium sanguineum, Lathyrus heterophyllus* (mkt rikl. i ett mindre grustag),

Fig. 3. Utbredningen inom undersökningsområdet av *Fragaria viridis*, *Brachypodium pinnatum*, *Phleum phleoides* och *Primula veris*. — För *Brachypodium pinnatum* avse de fyllda ringarna lokaler på torr mark, de ofyllda ringarna förekomster i kärr, längs bäckar och över huvud taget på fuktig mark. — *Phleum phleoides* är allmän inom det streckade området. — *Primula veris* är i södra Västergötland utanför området endast sedd vid Skene köping.

Phleum phleoides, Potentilla Crantzii och *Tabernaemontani, Primula veris* och *Ranunculus polyanthemus.*

Även i Hössnadalen träffar man på kontinentala örtbackssamhällen, särskilt i Knätte och Hössna. Den rikaste förekomsten möter man på den höga moränkullen 500 m S om Knätte kyrka. Toppen krönes med rika bestånd av *Salix depressa* (jfr sid. 678).

De stäppväxter, som tilldraga sig det största intresset, äro givetvis *Dracocephalum* och *Pulmonaria angustifolia.* Under det att den förra uteslutande anträffas på torra, mot S och SO exponerade moränbackar och slänter invid odlingsrösen, finner man *Pulmonaria* i björkhagar (Dalum: Svenstorp), fuktig ängsmark (Dalum: Vång), åbrinkar, även under stark beskuggning (Dalum: Flate), ekbackar (Timmele: Kattåkra), på rullstensåsar (Knätte: S om kyrkan) och i lövängar (Blidsberg: Kässeberg). Dessutom växer arten på järnvägsbanken inom Dalum och Blidsberg och då understundom i stor myckenhet (100-tals individ). Ett studium av kartorna ger vid handen att *Dracocephalum* har en relativt jämn utbredning i Ätradalen ned till Timmele, medan *Pulmonaria*'s förekomster i huvudsak äro koncentrerade till dalens mellersta socknar, Blidsberg och Dalum.

Vad beträffar *Lathyrus heterophyllus* ifrågasätter Kjellberg, om arten verkligen är indigen. Jag förstår honom, ty vingvialen visar verkligen en påtaglig benägenhet att ty sig till odlingen. Åtskilliga av dess förekomster utgöras av torra, branta slänter, gamla slåttermarker, som alltjämt hävdas. Säkerligen ha dessa slänter aldrig kunnat djupplöjas. Möjligen ha de bearbetats för hand med hacka. Om *Lathyrus heterophyllus* odlats i äldre tider, undandrager sig mitt bedömande, men det synes mig underligt, att arten sällan eller aldrig i likhet med sin frände *L. silvestris* i södra Västergötland förekommer på fullt naturliga ståndorter.

Potentilla rupestris uppträder inom området nästan uteslutande på torra moränbackar, vid odlingsrösen samt på järnvägs- och landsvägskanter och endast undantagsvis som i Vists socken på klipphyllor och i bergsskrevor i bergsstupen, ett förekomstsätt som eljest är typiskt för artens fåtaliga lokaler i sydvästra Västergötland.

Det synes mig anmärkningsvärt, att *Brachypodium pinnatum*, som på Falbygden hör hemma i stäppvegetationen, inom mitt område även uppträder på fuktig ängsmark, längs bäckar, smärre vattendrag och t.o.m. i rena kärr, något som kanske kan tänkas sammanhänga med artens ökade behov av elektrolyter i trakter med mindre kalkhalt hos moränen.

Som jag tidigare antytt, avta stäppväxterna successivt i frekvens söderut i Ätradalen för att slutligen helt utebli. *Galium triandrum* når ej sydligare än N. Åsarp. *Helianthemum nummularium* har sina sydligaste kända förekomster i Kölaby och Hössna. *Scabiosa columbaria*, som av NAEZÉN uppges från Ulricehamn, har i senare tid icke iakttagits sydligare än i Dalum. *Dracocephalum*, *Pulmonaria angustifolia*, *Trifolium montanum* och *Viola rupestris* nå ned till Timmele och Hössna. *Trifolium montanum* saknas dock helt i Hössnadalen. *Potentilla rupestris* når till Vist och *Artemisia campestris* till Ulricehamn, under det att *Brachypodium pinnatum* och *Fragaria viridis* ha insamlats i Marbäck. *Cirsium acaule*, *Lathyrus heterophyllus*, *Phleum phleoides* och *Viola hirta* äga några isolerade förekomster i socknarna närmast S om Åsunden. Ännu sydligare äro *Geranium sanguineum*, *Inula salicina* och *Ranunculus polyanthemus* iakttagna. Dessa arter äga några strölokaler söder om mitt område i mellersta Kind, i resp. Svenljunga, Örsås och Tranemo socknar.

Västerut, i Ås härad, äro stäppväxterna betydligt sällsyntare än i Redväg, vilket sannolikt beror på att häradet i sin nordligare del nära nog helt saknar rullstensåsar. Den rikaste stäppväxtförekomsten träffar man på sluttningarna kring Hof i Hällstad, varifrån jag noterat *Agrimonia eupatoria*, *Cirsium acaule*, *Geranium sanguineum*, *Lathyrus heterophyllus*, *Ononis arvensis*, *Potentilla Crantzii* och *rupestris*, *Pulmonaria angustifolia*, *Ranunculus polyanthemus* och *Satureja acinos*, av vilka *Ononis* här har sin enda nutida förekomst i södra Västergötland. Däremot saknas *Galium triandrum*, *Helianthemum*, *Scabiosa columbaria*, *Trifolium montanum* och *Viola rupestris* helt och hållet i Ås. *Pulmonaria angustifolia* är ej funnen sydligare i häradet än vid Hof i Hällstad, *Dracocephalum* och *Fragaria viridis* i Varnum och *Phleum phleoides* i Rångedala. *Cirsium acaule* har påträffats i S. Ving vid Tolken, under det att *Brachypodium pinnatum* och *Viola hirta* ha sina sydligaste utposter i Äspered vid samma sjö. *Geranium sanguineum* och *Potentilla rupestris* lära i äldre tider ha insamlats såväl i Toarp som Borås (NORDVALL 1867), under det att de i nutiden ej ha noterats sydligare än i Rångedala. Från sistnämnda socken uppger KJELLBERG jämväl *Inula salicina*, under det att *Crepis praemorsa* och *Ranunculus polyanthemus* äro iakttagna av SANDBERG & SÖDERBERG vid Borås.

Slutligen några ord om *Primula veris*, som ju är en stor sällsynthet i stora delar av Västsverige, och som i Sjuhäradsbygden egentligen blott förekommer inom mitt område. Vanlig i Ätradalen norr om

Åsunden äger gullvivan även några spridda förekomster i Hössnadalen, i Ås härad samt kring Åsunden. Sydligast är den iakttagen vid Torpa i Länghem, där den dock gör intryck av att vara inplanterad. Härutöver äger arten blott några få isolerade lokaler i brinkarna vid Viskan vid Skene köping 3,5 mil S om Borås.

5. Lundfloran.

En översikt av undersökningsområdets lundflora ger vid handen, att denna är rikare utbildad än i någon annan del av södra Västergötland. Områdets ädellövskogar hysa samtliga landskapets lövträd och flertalet av de buskar och örter, som äro funna i Sjuhäradsbygden, däribland en del arter, som helt saknas i de kringliggande fattigområdena. *Adoxa, Anemone hepatica, Chrysosplenium, Gagea lutea och Ranunculus ficaria* äro vanliga i socknarna kring våra båda större sjöar men avta i frekvens inom områdets perifera delar. Mera sparsamt uppträda *Actaea, Campanula latifolia* och *trachelium, Corydalis fabacea, Impatiens noli-tangere, Matteuccia, Mercurialis perennis, Milium, Polygonatum verticillatum, Stachys silvatica, Stellaria nemorum* och *Viola mirabilis*. Även *Anemone ranunculoides* hör till de relativt vanliga arterna, och dess utbredningskarta (fig. 7) ger en god bild över lundväxternas koncentration kring Åsunden och Tolken. Till bygdens ovanligare arter med blott ett fåtal förekomster höra *Brachypodium pinnatum* (jfr sid. 662), *Cardamine bulbifera* och *impatiens, Carex remota, Lathyrus niger* och *Pulmonaria officinalis*. Ännu sällsyntare äro *Bromus Benekeni, Carex silvatica, Euphrasia rostkoviana, Festuca altissima, Galium odoratum, Geranium lucidum, Lathyrus silvestris, Neottia, Orchis mascula* och *Poa remota*, som blott äro iakttagna på någon enstaka lokal.

Södra Västergötlands vackraste lundvegetation finner man på Kråkeboberg i Brunns socken (Westfeldt 1947). Rik är även floran nedom Klevaberget i S. Säm. Platån ovan stupet i sistnämnda berg täcks av en barrblandskog med inslag av asp, björk, ek, hassel och rönn och med ett fältskikt av blåbär, lingon, ljung, *Anemone nemorosa, Calamagrostis arundinacea, Festuca ovina, Pteridium* m. fl. Vid bergets fot växer en snålt sparad ridå av alm, ask, björk, ek, lind, lönn och rönn med enstaka individ av hassel, *Crataegus calycina* (*curvisepala*), *Lonicera xylosteum, Rhamnus catharticus* och *frangula* samt *Viburnum*. Rikare är fältskiktet, som bl. a. hyser *Actaea, Adoxa, Anemone hepatica* och *nemorosa, Astragalus glycyphyllus, Campanula*

latifolia, persicifolia och *trachelium, Cardamine bulbifera* och *impatiens, Carex digitata* och *elongata, Chrysosplenium, Circaea alpina, Cystopteris, Gagea lutea, Impatiens noli-tangere, Lactuca muralis, Lathraea, Lathyrus niger* och *vernus, Matteuccia, Melandrium rubrum, Mercurialis, Milium, Moehringia, Polygonatum odoratum* och *verticillatum, Primula veris, Pulmonaria officinalis, Scrophularia nodosa, Stachys silvatica, Stellaria longifolia* och *nemorum, Vicia sepium, Viola mirabilis, Woodsia ilvensis* och i en mindre rasmark *Poa remota*. I ett fuktigare parti några tiotal meter från stupets norra del växa *Carex caespitosa* och *acutiformis* och den snart sagt nära nog allestädes uppträdande *Epilobium adenocaulum*.

6. Kalkkärrens flora.

Vad som förutom de suboceaniska växtelementen särskilt frapperar vid studiet av Naezéns artlista är uppgifterna om att *Cladium* och *Orchis latifolia* skulle ha funnits vid Ulricehamn i äldre tider. Uppgiften om den senare arten måste bero på en felbestämning. Fyndet gällde säkert *Orchis incarnata*. Beträffande *Cladium* anmärker Naezén blott »in paludibus». Kalkkärr saknas i nutiden helt och hållet i socknarna närmast Ulricehamn. Det har säkerligen tidigare funnits en del kärrmarker vid Ätrans utlopp i Åsunden, men de torde ha försvunnit och med dem *Cladium* i samband med sjösänkningen på 1800-talet.

Det är blott i N. Åsarp och Dalum, som man i våra dagar kan finna några reminiscenser av de forna kalkkärren, som efter utdikningarna övergått till fuktiga gräs- och starrängar. Ledarter för dessa ängsmarker äro *Carex caespitosa, capillaris, flacca* och *lepidocarpa, Epipactis palustris, Orchis incarnata, Polygala amarella, Primula farinosa, Schoenus ferrugineus* och den senglaciala relikten *Saussurea alpina*.

I nordvästra delen av den stora myren Ö om N. Åsarps kyrka finner man mellan rullstensåsen och mossens plan ett rätt så vidlyftigt rikkärr med gungfly och en del öppna gölar. Trädskiktet omkring kärret domineras av björk, gran och tall, vartill komma enstaka ungplantor av ek, oxel och rönn. I buskskiktet möter man *Salix aurita, caprea, cinerea, nigricans* samt *pentandra*, och på fastmarken nedom prästgården växer *Cornus alba* i stora buskage. Vattnet är grunt ute i gölarna, och av submersa växter finner man blott *Utricularia intermedia* och *Chara contraria*, under det att enstaka

Fig. 4. Utbredningen inom undersökningsområdet av *Epipactis palustris*, *Carex capillaris*, *C. flacca* och *Polygala amarella*.

strån av *Carex vesicaria*, *Equisetum palustre* och *Scirpus pauciflorus* sticka upp över vattenytan. Gungflyets vedväxter äro få och småväxta och utgöras av björk, gran och tall, vartill komma en och odon samt ett överflöd av *Salix hastata*. Den sistnämnda varierar här liksom annorstädes i Redväg till storlek och utseende, från ¾ m höga

buskar till knappt decimeterhöga, risliknande individ. I de öppna partierna kring gölarna och på gungflyet öster därom har jag i fältskiktet noterat *Angelica, Briza, Cardamine pratensis, Carex capillaris, chordorrhiza, diandra, dioeca, fusca, lepidocarpa, limosa, panicea, vesicaria, Cirsium palustre, Drosera rotundifolia, Empetrum, Equisetum palustre, Eriophorum latifolium, Filipendula ulmaria, Galium uliginosum, Geum rivale, Hieracium rigidum, Luzula multiflora, Menyanthes, Orchis incarnata, Pedicularis palustris, Pinguicula vulgaris, Platanthera bifolia, Polygonum viviparum, Potentilla erecta, Primula farinosa, Pyrola minor, Ranunculus acris, Scirpus hudsonianus* och *pauciflorus, Triglochin, Tussilago, Vaccinium oxycoccus,* och *Valeriana sambucifolia.* Härtill kommer ett fåtal individ av kärrets största prydnad, *Pedicularis sceptrum-carolinum.* Även bottenskiktet hyser en del intressanta, delvis typiska rikkärrsarter såsom *Bryum ventricosum, Calliergon stramineum, Campylium stellatum, Cinclidium stygium, Drepanocladus revolvens, Philonotis fontana,* m. fl. pH-värdet, som i en kärrgöl bestämdes till 7,2, utgjorde i närheten av en *Orchis*-tuva på gungflyet 6,4.[1]

3 km Ö om prästgårdskärret i N. Åsarp utbreder sig i övergångszonen mellan fastmarken och mosseplanet S om Valunda ännu ett rikkärr, i vilket jag bl. a. noterat *Carex caespitosa, flacca, hostiana* och *lepidocarpa, Crepis praemorsa, Eriophorum latifolium, Hierochloë odorata, Linum catharticum, Orchis incarnata, Pinguicula vulgaris, Polygala amarella, Polygonum viviparum, Primula farinosa, Salix hastata, Schoenus ferrugineus, Scirpus hudsonianus* samt bland mossorna *Drepanocladus revolvens, Scorpidium scorpioides* och *Splachnum ampullaceum.*

Strax N om Dalums järnvägsstation ligger Tingvallakärret alldeles invid landsvägen och hårt hotat av bebyggelsen.[2] Kärret saknar synligt avlopp, varför överflödsvattnet måste ha något underjordiskt utlopp. I kärrets södra hälft ligga några smärre öppna vattenytor omgivna av gungflyn med grupper av björk och videbuskar och enstaka furor. I öppet vatten växa *Hydrocharis, Lemna minor, Myriophyllum alterniflorum, Nuphar luteum, Potamogeton natans, Stratiotes, Utricularia intermedia* och *vulgaris,* under det att stränderna kantas av *Carex elata, Menyanthes* och *Potentilla palustris* samt inom ett mindre parti av den i bygden ytterligt sällsynta

[1] Samtliga pH-bestämningar äro utförda av civilingeniör Nils Landqvist (Rydboholm) med Radiometers pH-mätare med glaselektrod.

[2] Svårt skadat genom vägbreddning sommaren 1954.

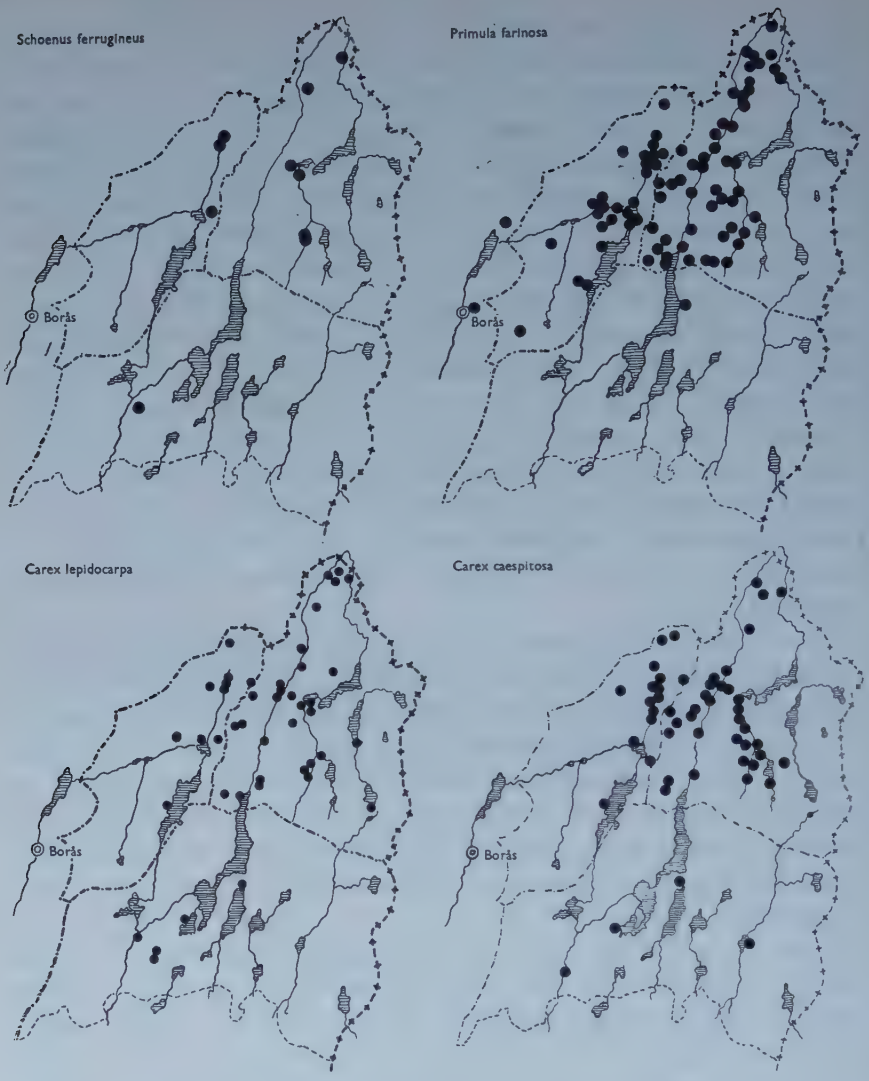

Fig. 5. Utbredningen inom undersökningsområdet av *Schoenus ferrugineus*, *Primula farinosa*, *Carex lepidocarpa* och *C. caespitosa*.

Lastrea thelypteris. pH-värdet bestämdes i juli 1952 till 7,2 i ett av de öppna vattnen. Gungflyets vegetation består eljest av *Agrostis canina*, *Andromeda*, *Calluna*, *Caltha*, *Cardamine pratensis*, *Carex canescens*, *diandra*, *fusca* och *vesicaria*, *Drosera rotundifolia*, *Equisetum fluviatile*, *Eriophorum angustifolium* och *latifolium*, *Filipendula ulmaria*, *Galium palustre*, *Juncus articulatus*, *Lycopus*, *Lysimachia*

vulgaris, Pedicularis palustris, Peucedanum, Phragmites, Potentilla erecta, Pyrola minor, Scirpus hudsonianus, Scutellaria galericulata, Stellaria palustris, Thalictrum simplex, Trientalis, Vaccinium oxycoccus, Valeriana sambucifolia, Vicia cracca, Viola palustris samt *Typha latifolia*. Den sistnämnda måste efter allt att döma vara en sen inkomling i kärret. Invid fastmarkspartierna nedom järnvägen tillkommer dessutom *Carex flacca* och *lepidocarpa, Linum catharticum, Polygala amarella* samt *Scirpus hudsonianus*. Kärrets intressantaste arter äro förutom *Lastrea thelypteris Carex vulpina* och *Viola stagnina*, som här i Dalum och några grannsocknar ha ett fåtal från arternas sydsvenska utbredning i övrigt relativt starkt isolerade förekomster. Båda arterna växa på fast mark, som dränks vid högvatten.

Ett av nordöstra Sjuhäradsbygdens vackraste kalkkärr ligger 1 km S om Vinsarps gård på gränsen mellan Dalum och Böne i Hössnadalen.[1] Detta kärr var tidigare avsevärt större. Efter Vinsarpsjöns sänkning och Ätrans kanalisering har en stor del förvandlats till åkerjord. I dag återstår blott en ringa del längst i SV, där vassen för varje år alltmer vinner terräng, samtidigt som fröplantor av tall spira i de torrare partierna. Inom kärrets fuktigare delar finner man ännu rikligt med kalkväxter, *Carex appropinquata, caespitosa* och *lepidocarpa, Epipactis palustris, Lathyrus palustris, Linum catharticum, Orchis incarnata* och *Traunsteineri, Polygala amarella, Primula farinosa, Saussurea, Schoenus ferrugineus, Scirpus hudsonianus* och *Viola epipsila*. Albertson utförde 1944 i sällskap med förf. en analys av mossvegetationen, som gav vid handen, att denna i hög grad överensstämmer med den i Falbygdens rikkärr. *Campylium stellatum, Drepanocladus intermedius, Fissidens adiantoides* och *Scorpidium scorpioides* dominera i de måttligt våta samhällena. Vidare anträffades rikligt med *Tomenthypnum nitens* samt i *Sphagnum*-rika partier *Bryum ventricosum, Calliergon stramineum* och levermossan *Riccardia pinguis*. I det klarast kärrbetonade NV-partiet växte tvenne typiska extremrikkärrsarter, *Ctenidium molluscum* och *Cratoneurum falcatum*. I ett vattenprov från detta kärr bestämdes pH-värdet 1946 av Witting till 6,8 och kalciumhalten till 18,56 mg/l.

En intressant rikkärrsvegetation finner man även i den lilla dalsänkan mellan Önnarp och Oset i Hössna. I dalbottnen nedom sluttningarnas lövängsfragment möts man av en för trakten osedvanligt

[1] Enligt vad jag på sistone erfarit, ligger »Vinsarpskärret» på prästgårdens ägor i Böne socken. Då kärret såväl i litteraturen som på herbarieark städse hänförts till Dalum, har jag icke gjort någon ändring i fyndortsförteckningen.

yppig vegetation, en fuktäng, som delvis visar tendens att övergå i kärr. Visserligen saknas några av rikkärrens ledarter såsom *Polygala amarella* och *Schoenus*, men artlistan är ändock imponerande med *Carex acutiformis, caespitosa, disticha, flava* och *lepidocarpa, Crepis praemorsa, Epipactis palustris, Eriophorum latifolium, Linum catharticum, Listera ovata, Primula farinosa, Salix hastata, Scirpus planifolius*, vartill komma *Cirsium oleraceum* och *Saussurea alpina* (Westfeldt 1939).

Söderöver bli kalkkärren sällsyntare. Vid Djurgården S om Torpa i Länghem växa i ett delvis utdikat och igenvuxet kärr bl. a. *Carex caespitosa, flava* och *lepidocarpa, Eriophorum latifolium, Linum, Orchis Traunsteineri, Pinguicula, Scirpus hudsonianus* och *Viola epipsila*. I laggen i mossen SV om Åsendal på gränsen mellan Hillared och Sexdrega fann Bliding 1951 *Schoenus* tillsammans med *Carex hostiana, Eriophorum latifolium, Orchis incarnata* och *Pinguicula*, och i fastmarkskanten växer märkligt nog även *Narthecium*. I *Schoenus*' omedelbara grannskap insamlade jag några av rikkärrens ledmossor: *Calliergon trifarium, Campylium stellatum, Drepanocladus revolvens, Fissidens adiantoides, Scorpidium scorpioides* och *Splachnum ampullaceum*.

Dessa rikkärrsarter i norra Kind ha säkerligen rullstensåsarna att tacka för sin tillvaro. Djurgårdskärret i Länghem ligger omedelbart invid Ulricehamnsåsen, under det att mossmarken SV om Åsendal gränsar intill en mindre rullstensås, som från Hillareds järnvägsstation löper i sydvästlig riktning mot Lysjön.

I Ås härad finnas inga egentliga kalkkärr i behåll i nutiden. Mossen S om Möne kyrka har säkerligen i äldre tider hyst en rik kalkkärrsflora, varom smärre bestånd av bl. a. *Carex lepidocarpa, Epipactis palustris, Inula salicina, Polygala amarella, Primula farinosa, Saussurea* och *Schoenus* i mosskanten nedom Lunden i Hällstads socken vittna.

På 1870-talet sänktes flertalet sjöar längs Viskan i mellersta Ås. Den direkta vinsten av dessa torrläggningsföretag blev, att en del mossmarker förvandlades till fastmark och att sjöbottnarna, särskilt de kring Mogden och Varnumssjöarna, övergingo till sandiga, ofta översvämmade mosandsområden, som först långt in på 1900-talet blevo skogbeväxta. Det är att beklaga, att ingen växtbiolog varit i tillfälle följa och studera florans invandring och utveckling på dessa sjöbottnar. Först i början av detta sekel fingo tvenne boråsbotanister, framlidne rektor Carl Sandberg och apotekare Ivar Söderberg

(Växjö), sin uppmärksamhet fäst på den egenartade floran kring Varnumssjöarna, men då var tyvärr redan det intressantaste utvecklingsskedet passerat.

Vad som särskilt frapperar vid ett besök på ovannämnda lokaler är förekomsten av en del för trakten och orten sällsynta för att icke säga främmande element. På 1920-talet fann förf. ett tiotal, 4—5 m höga exemplar av *Salix daphnoides* ssp. *acutifolia* på olika punkter kring Varnumssjöarna. De flesta individen voro då nästan omkullvräkta, sannolikt sönderskruvade av vårisarna. Antagligen härstamma samtliga exemplar från odlade i omgivningen. Dylika växte ännu 1930 såväl vid kyrkan i Rångedala som vid Ågården i Varnum. Daggvidet är nu sedan många år försvunnet. Härutöver kunna noteras *Botrychium multifidum*, *Equisetum variegatum*, *Salix hastata*, *Taraxacum suecicum* och *Viola epipsila*, vartill kommer den lilla bladmossan *Aongstroemia longipes* (Sandberg & Söderberg 1922 *b*). *Botrychium multifidum* uppträdde under en följd av år på 1920-talet vid såväl Mogden som Varnumssjöarna, utan att ha kunnat återfinnas under de senaste decennierna. 1933 fann jag den däremot på en gammal igenvuxen betesmark vid Lottenborg i S. Ving, vilket tycks tyda på, att arten är indigen i bygden, något som f. ö. styrks av läroverksadjunkt Axel Harpens (Göteborg) fynd vid Mellsåkern i Toarp. *Salix hastata*, som är ganska vanlig i norra Redväg, växer rikligt på flera ställen i Fänneslunda, Rångedala och Varnum, huvudsakligast i vägdiken men även på de forna sjöbottnarna och N om Varnumskulle station i ett gammalt grustag. *Taraxacum suecicum* hör jämte *Carex vulpina* och *Viola stagnina* till en grupp arter, som från sitt egentliga utbredningsområde ha några få mot SV framskjutna utposter i Sjuhäradsbygden. *Equisetum variegatum* hade länge sin enda kända fastlandslokal i Götaland kring Varnumssjöarna (jfr Holmberg 1922). Rudberg uppger den även från Mösseberg, men uppgiften förefaller problematisk och fordrar bekräftelse.

På gränsen mellan Länghem, Hillared och Sexdrega ligger invid Ulricehamnsåsen ett större myrkomplex, Måleksområdet, som trots att det i huvudsak består av mossar och fattigkärr i vissa avsnitt även hyser en del calcifila element, *Carex diandra* och *lepidocarpa*, *Eriophorum latifolium* o. a. Invid fastmarken i områdets nordöstra del övergår mossen i ett 50 m brett kärrstråk av fattigtyp, vilket genomdrages av en mindre bäck. Ifrågavarande område hyser ett rikt bestånd av *Orchis Traunsteineri* med individ som äro upp till 60 cm höga. Denna förekomst synes mig så mycket märkligare, som

ifrågavarande orkidé brukar hänföras till de avgjort kalkgynnade. Dock lär det enligt professor NANNFELDT icke vara ovanligt, att arten i vissa trakter, speciellt västerut, uppträder i fattig vegetation utan kalk och vid lågt pH. *Orchis Traunsteineri* växer här delvis i rena *Sphagnum*-bestånd (*S. imbricatum, pulchrum* och *rubellum*) och i en oligotrof omgivning med *Aulacomnium palustre, Calliergon stramineum, Cephalozia connivens, Dicranum Bergeri* och *Bonjeani, Gymnocolea inflata, Mylia anomala, Pohlia nutans* och *Polytrichum strictum*. En ståndortsanteckning från ett av de vackraste *Orchis*-bestånden gav följande artlista: *Andromeda, Calluna, Carex lasiocarpa* (steril), *livida* och *magellanica, Drosera anglica* och *rotundifolia, Erica, Eriophorum angustifolium, Menyanthes, Myrica, Rhynchospora alba, Scheuchzeria, Scirpus *austriacus, Trientalis, Utricularia intermedia* och *Vaccinium oxycoccus*. pH-värdet var i en göl med klarvatten omedelbart intill ett större *Orchis*-bestånd 5,0, under det att ett annat prov hämtat från 2 dm djup under samma tuva gav värdet 6,2.

Av det föregående torde framgå, hur våra calcifila kärrväxter successivt avta i frekvens söderut för att slutligen helt utebli. Under det att flertalet i likhet med stäppväxterna äro inskränkta till trakterna N om Tolken och Åsunden, finner man *Carex acutiformis, caespitosa, lepidocarpa, Gymnadenia conopsea, Orchis incarnata* och *Traunsteineri, Schoenus, Scirpus planifolius* o. a. på enstaka punkter söder om nyssnämnda sjöar. Gemensamt för dem alla är dock, att deras utbredning helt och hållet faller inom det område, som täcks av kalkrika moräner och insjöleror. Egentligen skulle mina undersökningar sträckt sig över hela Kind för att få detta mitt påstående ytterligare belyst. Enligt vad jag inhämtat av UNO BERGENGREN (Örsås), saknas dock stäppväxter och calcifila element helt och hållet inom häradets sydligare delar. Det skulle emellertid icke förvåna mig alltför mycket, om *Orchis Traunsteineri* skulle bli funnen på en eller annan lokal i mellersta Kind.

7. De nordliga arterna.

Som jag antydde i min *Saussurea*-uppsats 1927, var ifrågavarande senglaciala relikt då känd från ett 20-tal lokaler i Västergötland. Antalet kända förekomster har sedan dess stigit till ungefärligen det dubbla, varav ¾ i Hössna-dalen, »*Saussurea*-dalen i Västergötland». Trots denna påtagliga ökning av antalet kända lokaler finns det intet, som tyder på, att arten skulle vara stadd i spridning i nutiden.

Det är säkerligen blott äldre, tidigare ej kända förekomster, som undan för undan påträffas. Det föreföll länge, som om *Saussurea* skulle vara strängt lokaliserad till Ulricehamnstrakten, tills Fridén fann ett litet bestånd i Sjöängen i Slöta (Albertson 1951). I min *Saussurea*-uppsats uppgav jag, att framlidne kapten Carl Stenholm skulle ha sett arten för många år sedan vid Sverkilstorp i Kölaby. Jag har dessvärre aldrig kunnat återfinna denna lokal, men Stenholms uppgift bekräftas av ett ark i Göteborgs-herbariet, insamlat i Kölaby 1887 av N. P. Stenholm, en broder till föregående.

Saussurea's lokaler utgöras dels av kalkkärr, dels av sidlänta, ± översilade gräs- och starrkärrängar, vilka delvis alltjämt hävdas. Vid Svenstorp i Dalum och Brunsered i Hössna växer arten på renarna till gamla, nästan helt igengångna diken i fuktig slåtteräng, och nedom Lunden i Hällstad ser man den även på det ur diket uppkastade materialet. Vid Redvägsborg i Timmele växer *Saussurea* i landsvägsdiket. Dessa sista exempel kunna synas jäva mitt tidigare påstående, att arten ej skulle vara stadd i spridning, men på ifrågavarande lokaler träffas arten i omgivningen jämväl på fullt naturliga ståndorter. I tuvig betesmark växer den även i tuvornas perifera partier, som vackert draperas av de nedhängande bladen. Antalet inflorescenser varierar avsevärt på skilda lokaler. Under det jag i Möne blott funnit några enstaka blommande individ, räknade jag 1926 i ängsmarken nedom Brunsered i Hössna till över 100 dylika.

Det är tydligt, att *Saussurea* måste vara kalkgynnad i Västergötland. Medan den av Hård (1922) hänföres till »nordliga arter, som anknyta sig till kalktrakterna», betecknas den av Albertson (1946) som ledart för *Euscorpidion* i trakterna norr om Ulricehamn. Växtens fordringar på kalkhaltigt substrat tyckas dock variera på skilda ståndorter, och jag kan ej underlåta att pointera, att av artens västgötalokaler är det blott en, Slöta i Skaraborgs län, som faller inom det egentliga silurområdet.

Den uppgjorda tabellen bygger beträffande kärlväxterna helt på egna iakttagelser. Från Vinsarpskärret i Dalum föreligger ingen mossanalys, utan tabellens uppgifter basera sig på Albertsons (jfr ovan sid. 669) och Wittings (1947) artlistor. Provytorna äro beträffande fanerogamerna samtliga om 1 kvm under det att mossproven ha insamlats inom ett något vidsträcktare område. Utökas rutstorleken till den 10-dubbla, eller gör man fullständiga beståndsanalyser, inträder en förskjutning av *Saussurea*-samhällenas hela struktur. Några arter såsom *Alnus incana, Cirsium heterophyllum, Polygonum vivi-*

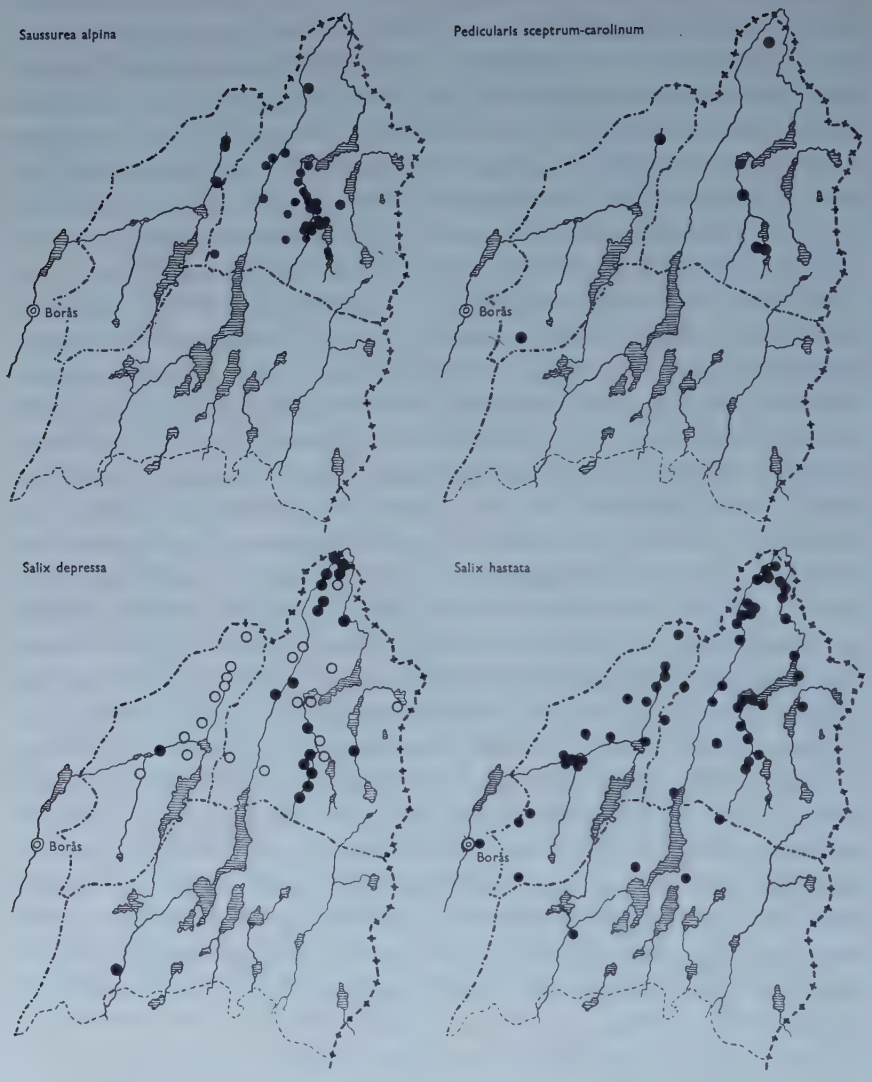

Fig. 6. Utbredningen inom undersökningsområdet av *Saussurea alpina*, *Pedicularis sceptrum-carolinum*, *Salix depressa* och *S. hastata*. — *Saussurea alpina* är i Västergötland utanför området endast sedd på 2 lokaler, den ena på Falbygden, den andra i Skölvene sn 3 mil NV om Åsundens nordända. — *Pedicularis sceptrum-carolinum* är i södra Västergötland även sedd i Eriksberg 3 mil NV om Ulricehamn. — För *Salix depressa* avse de fyllda ringarna förekomster på rullstensåsar, de ofyllda ringarna lokaler på fuktig mark.

parum, Salix nigricans, som saknas i tabellen, visa sig då vara konstanta.

Vid Karlabo i Gullered har *Pedicularis sceptrum-carolinum* sin rikaste förekomst i södra Västergötland. Uppgiften har ursprungligen lämnats mig av NORDHOLM, som uppgav arten från ytterligare några platser i sin hemsocken, där den dock ej kunnat återfinnas. Antalet blommande individ växlar vid Karlabo år ifrån år. Det högsta antalet jag räknat till vid något tillfälle är 60. 1933 påträffade jag ett par meterhöga exemplar i ett *Saussurea*-kärr Ö om Lunds by i Knätte. 1951 blev jag av FRIDÉN uppmärksamgjord på att växten jämväl förekommer i prästgårdskärret i N. Åsarp. Däremot tycks den vara utgången på sina sedan gammalt kända lokaler i Möne och Dalum. I Göteborgs Botaniska Trädgårds herbarium ligger slutligen ett ark, insamlat av OLSON 1883 i Toarp, St. Bygd (Kilängen). Det är oklart, vad OLSON egentligen avsåg med Kilängen. Arten har ej kunnat återfinnas på Bygd i senare tid.

Förutom *Pedicularis sceptrum-carolinum* och *Saussurea* hyser nordöstra Sjuhäradsbygden ytterligare några nordliga arter, kalkgynnade såväl som oligotrofa. Bland de förra må nämnas *Carex capillaris* och *Buxbaumii, Salix depressa* och *hastata, Viola epipsila* m. fl. Sällsyntast bland dessa är *Carex Buxbaumii,* som blott anträffats på tvenne lokaler, i Hössna och S. Ving. RUDBERG uppger arten även för Solberga (Baggekvarn), där den emellertid ej kunnat återfinnas. ROSENDAHL (1916) uppger *Woodsia alpina* från Toarp (Målsryd, leg. Olson). I våra offentliga herbarier inklusive läroverksherbariet i Borås finns allt som allt blott ett ark från Toarp, vilket vid närmare granskning av dr E. ASPLUND visat sig vara *Woodsia ilvensis.* Denna tolkning styrks f. ö. av att *Woodsia alpina* i södra Sverige är kalkbunden. ROSENDAHLS Toarps-uppgift har utelämnats hos såväl HOLMBERG (1922) som HULTÉN (1950). I Vinsarps- och Viesjöarna i Dalum växer *Nuphar luteum* × *pumilum,* varslande om att ren *pumilum* säkerligen funnits i trakten i äldre tider. *Carex loliacea* är i senare tid sedd av HARPEN i Dalum. RUDBERG uppger den från Böne och HÅRD från S. Ving. *Equisetum variegatum* och *Botrychium multifidum* ha omnämnts i annat sammanhang (sid. 671). *Poa remota* förekommer i Rångedala och S. Säm, varjämte den sedan gammalt är känd från Kröcklings hage i Gingri, en grannsocken till Rångedala. Dessa tre förekomster äro de enda säkra i Sjuhäradsbygden. Hos RUDBERG och HOLMBERG finns därutöver en obekräftad uppgift från Kölingared. *Galium trifidum* växer i sjön Grosken i Grovare samt vid

Tabell I. Kärlväxt- och mossflorans sammansättning på några *Saussurea*-lokaler.

Arter	Timmele: Nilsagården	Timmele: Nilsagården	Dalum: Vinsarpskärret	Hössna: Önnarp	Hössna: Krokstorp	Knätte: 400 m SV om kyrkan	Brunn: Långsered	Hällstad: Lunden
	1	2	3	4	5	6	7	8
Betula spec.	+	+	+	+	+	+	+	+
Juniperus communis		+		+	+	+		
Picea abies	+	+	+	+		+		
Rhamnus frangula				+				
Salix aurita				+				
» *nigricans*				+				
» *repens*			+					
Agrostis canina				+				+
Anemone nemorosa								+
Angelica silvestris				+	+			
Anthoxanthum odoratum				+				
Brachypodium pinnatum							+	+
Briza media	+						+	
Calluna vulgaris			+		+	+		
Carex dioeca		+	+					
» *fusca*							+	
» *hostiana*								+
» *lepidocarpa*		+			+			+
» *panicea*	+	+	+	+	+		+	+
» *vaginata*			+					
» *vesicaria*	+	+						
Cirsium oleraceum				+				
Crepis paludosa				+	+			
Drosera rotundifolia					+	+		
Equisetum palustre	+	+	+	+	+	+	+	+
Erica tetralix							+	
Eriophorum latifolium		+			+	+		+
Festuca ovina	+						+	+
Filipendula ulmaria	+		+	+				+
Galium boreale			+	+		+	+	
» *palustre*				+		+	+	+
» *uliginosum*			+	+	+		+	+
Geum rivale	+							+
Lathyrus montanus				+				
Menyanthes trifoliata			+		+		+	
Molinia coerulea					+	+		+
Parnassia palustris			+		+	+		+
Phragmites communis						+		
Pinguicula vulgaris		+			+	+		

(*Tabell I.* Forts.)

	1	2	3	4	5	6	7	8
Polygala amarella								+
Potentilla erecta	+	+	+	+	+	+	+	+
» *palustris*			+	+	+			
Primula farinosa								+
Rubus saxatilis						+		
Saussurea alpina	+	+	+	+	+	+	+	+
Taraxacum spec.								+
Trientalis europaea							+	
Triglochin palustre	+							+
Tussilago farfara								+
Vaccinium oxycoccus						+	+	
» *uliginosum*			+					
» *vitis-idaea*		+				+	+	
Vicia cracca			+			+	+	+
Viola palustris				+	+		+	
Aulacomnium palustre		+		+	+	+	+	
Bryum ventricosum			+	+	+	+		
Calliergon stramineum		+	+	+	+	+	+	
Calliergonella cuspidata		+	+		+		+	
Campylium stellatum		+	+	+	+	+	+	
Cratoneurum commutatum			+					
» *falcatum*			+		+			
Ctenidium molluscum			+		+			
Drepanocladus intermedius			+	+				
» *revolvens*		+	+	+	+		+	
Fissidens adiantoides		+	+		+		+	
Hylocomium splendens		+	+	+	+			
Mnium Seligeri				+	+		+	
Moerchia hibernica							+	
Mylia anomala			+		+			
Orthocaulis kunzeanus					+		+	
Paludella squarrosa							+	
Philonotis calcarea					+			
Pleurozium Schreberi			+				+	
Rhacomitrium canescens					+			
Rhytidiadelphus triquetrus				+				
Riccardia pinguis			+	+	+		+	
Scorpidium scorpioides			+	+				
Sphagnum centrale?					+			
» *contortum*					+		+	
» *nemoreum*		+			+			
» *teres*		+		+		+		
» *warnstorfianum*		+		+	+	+	+	
Tomenthypnum nitens		+	+	+	+	+	+	
Tortella tortuosa					+			

Valunda i N. Åsarp, och *Viola montana* äger några spridda förekomster. Spontan *Daphne* är blott känd från Marbäck. Dessutom ser man den någon gång förvildad, särskilt i Toarp. *Salix hastata* förekommer nästan uteslutande i Redväg och Ås och i regel endast i enstaka individ. Beståndsbildande uppträder den i N. Åsarp samt kring Varnumssjöarna (sid. 671). Den växer företrädesvis i kärr, på fuktig ängsmark samt på nyblottad jord, i vägdiken och på blottlagda sjöbottnar. *Salix depressa*, som enligt de floristiska handböckerna hör hemma i lövskogsängar och betesmarker samt på dikeskanter, uppträder understundom jämväl i rullstensåsarnas kontinentala örtbackssamhällen (sid. 657).

Carex brunnescens, globularis och *livida* samt *Eriophorum gracile* äro i likhet med *Betula nana* och *Ledum* inom området bundna till de mindre näringsrika områdena söderöver. Under det att *Carex globularis* har några spridda lokaler i nära anslutning till artens rika förekomster i nordvästra Småland, växer *Carex livida* huvudsakligast inom tvenne strängt lokaliserade områden, kring Komosse och inom Måleksområdet. *Carex brunnescens* är däremot endast känd från Toarp. *Ledum* är rikast företrädd i Redvägs östligaste socknar, Fivlered och Kölingared. F.ö. äger den spridda förekomster över hela området. *Betula nana* är endast sedd i norra Kind, i Hillared och Länghem. Uppgiften om att dvärgbjörken skulle ha påträffats vid Klevarna i Tärby (Nordvall 1867) har aldrig bekräftats.

8. Adventivväxterna.

Nordöstra delen av Sjuhäradsbygden är fattig på neofyter. Bland buskarna ha vi egentligen blott *Sambucus racemosa, Cornus alba* och *Berberis*, av vilka den förstnämnda sprider sig hastigt och uppträder i vitt skilda växtsamhällen. Vad beträffar *Berberis* visade det sig vid den inventering, som genom hushållningssällskapets försorg företogs efter det sista, svåra svartroståret 1951, att ifrågavarande buske är en stor sällsynthet. Enligt tillgängliga uppgifter är den sedd på 4 lokaler i Redväg, 2 i norra Kind och 10 i Ås. Det sammanlagda antalet kända individ torde, då förintelsekampanjen började, knappast ha överstigit 40, varav huvudparten växte i Äspereds socken. — *Elodea canadensis*, områdets kanske mest typiska neofyt, är numera vanlig i de flesta vattendragen. En växt, som spritt sig synnerligen hastigt över stora delar av södra Västergötland, är *Epilobium adenocaulum*. Den iakttogs första gången av apotekare S. A. Trolander

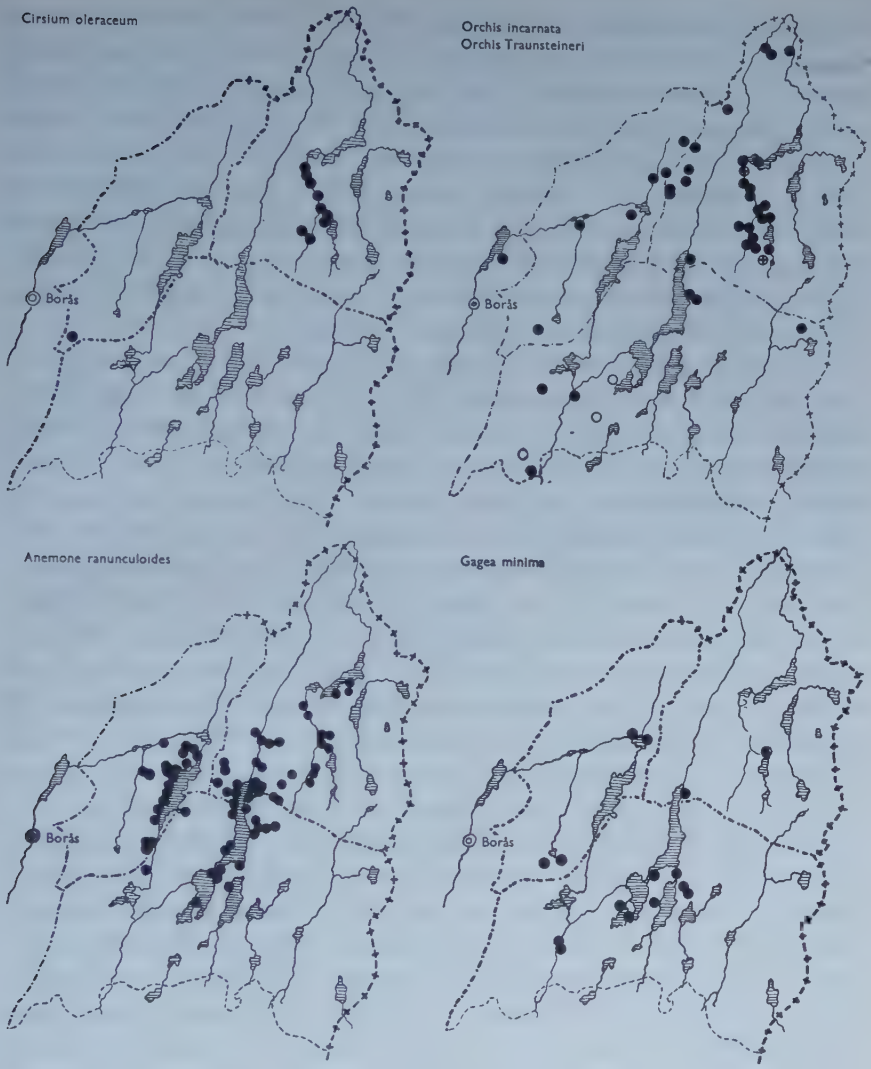

Fig. 7. Utbredningen inom undersökningsområdet av *Cirsium oleraceum*, *Orchis incarnata* (och *O. Traunsteineri*), *Anemone ranunculoides* och *Gagea minima*. — För *Cirsium oleraceum* avser den isolerade lokalen i sydväst en förvildad förekomst. — *Orchis incarnata* har betecknats med fyllda och *O. Traunsteineri* med ofyllda ringar. Ring med kors markerar förekomst för båda arterna.

(Växjö) vid Aplared i Ljushult 1920 och av förf. 1926 vid Vinsarp i Dalum. I dag är arten noterad från de flesta socknarna, rikligast i de oligotrofa delarna, där den stundom som vid kvarndammen vid Toarpsdal kan bli samhällsbildande. *Acorus* och *Petasites* finner man

som regel i gårdarnas grannskap, där de odlats sedan gammalt. *Petasites* växer rikligt i den lilla bäckfåran vid Taryd i Toarp, såväl ute i det rinnande vattnet som på fastmarken, och *Acorus* uppträder längs Ätran från N. Åsarp—Kölaby—Humla. *Glyceria maxima* förekommer i våra dagar rikligt utmed Ätran N om Åsunden. Huruvida man får anse den som indigen i dessa trakter undandrager sig mitt bedömande. Neofyt är den däremot med all säkerhet i några småsjöar inom områdets södra del. På några punkter har även *Impatiens Roylei* under de sista tio åren förirrat sig ut i naturlig miljö och uppträder som neofyt längs bäckar och på sjöstränder.

Rikt företrädda äro en del adventivväxter, som oavsiktligt införts av människan i senare tid. *Gagea minima*, som först under 1920-talet påvisats i södra Västergötland, är tydligt kulturspridd i våra bygder. I motsats till *Gagea lutea* saknas den helt och hållet på naturliga ståndorter och påträffas endast vid en del äldre sätesgårdar samt på ett par kyrkogårdar. Vid anläggning av trädgårdar har man sannolikt hämtat buskar och större örter från andra landsändar. Det förefaller då sannolikt, att *Gagea minima*'s lökar, vilka ju äro mycket små, nästlat sig in i plantornas rotsystem och på så sätt oavsiktligt transporterats från trakter, där arten har sitt egentliga hemvist, till vår bygd. *Chenopodium bonus-Henricus* påträffas uteslutande vid gårdar och på kyrkogårdar i trakterna N om Åsunden, där den sannolikt odlats i äldre tider. Lindgren (1841) påpekar, att »det förblifver en kuriositet om *Lamium album* aldrig påträffas inom landskapet» (Västergötland). I dag finner man vitplistern h. o. d. vid kyrkogårdar och herrgårdar och även vid smärre ställen i skogsbygden, där den med all säkerhet planterats från början. *Peucedanum ostruthium*, *Myrrhis odorata*, *Euphorbia cyparissias*, *Hesperis matronalis* och *Polemonium coeruleum* äro gamla odlingsrester, som dröjt sig kvar på lämpliga lokaler. I nyanlagda gräsmattor finner man *Crepis capillaris* och spridd kring äldre trädgårdsanläggningar *Hieracium aurantiacum*, *Lysimachia nummularia* och *Calystegia sepium*. Den senare är känd från Ulricehamn åtminstone sedan slutet av 1800-talet. I trädgården vid Torsbo i Gällstads socken fann jag sommaren 1954 tillsammans med *Luzula luzuloides* även den vida sällsyntare *L. silvatica*, som hittills blott varit känd från 3 lokaler i vårt land (Hultén 1950). På samma ställe växa också några exemplar av *Senecio jacobaea*, som även den är ny för bygden.

Beträffande åkergräsen är *Bunias* vanlig i norra Redväg. Söderut bli lokalerna mera tunnsådda, och i Kind och Ås uppträder den mer-

endels endast sporadiskt. *Melandrium album*'s utbredning sammanfaller med *Bunias*'. Den är dock vanligare söderut än denna. I fodervallar har jag under senare år iakttagit enstaka exemplar av *Lilium bulbiferum*. *Centaurea cyanus* är allmän inom de nordligare socknarna men sällsynt i Kind. *Agrostemma* och *Apera spica-venti*, som ännu på 1920-talet sågos här och var i åkrarna, äro i dag ytterligt sällsynta, under det att *Silene dichotoma* är stadd i spridning. Mycket sällan ser man numera våra speciella linogräs, *Camelina alyssum*, *Cuscuta epilinum* och *Lolium temulentum*, vilket torde sammanhänga med att linodlingen nästan helt upphört. De anteckningar jag gjort för ifrågavarande arter datera sig samtliga från 1920-talet. *Campanula patula* växer sällsynt i gamla vallar och på vägkanter. Den är merendels tillfällig och försvinner efter några år, men på några platser har den hållit sig kvar under längre tid. Tvenne arter, som under senare tid naturaliserats och vunnit vidsträckt spridning, äro *Cerastium arvense* och *Thlaspi alpestre*. Den förra är vanlig på åkrar och längs vägkanter på sandig jord. *Thlaspi* spred sig i början av detta sekel från en äldre spridningshärd kring Borås in i Toarps socken med omnejd. I Ulricehamnstrakten och Ätradalen är arten däremot sedd först under det senaste decenniet. Intressant synes mig även *Cerastium glomeratum*'s stora spridning över delar av mitt område. Särskilt rikligt uppträder den under fuktiga år och speciellt då kring ladugårdar och på vägkanter. En sen inkomling på snarlika lokaler är *Juncus macer*, som dock ännu är mycket sällsynt.

Längs områdets järnvägslinjer uppträder *Arabis arenosa* och *Chaenorrhinum*, understundom i sällskap med *Descurainia sophia*, *Lepidium densiflorum* och *Senecio viscosus*. Längs banlinjen Borås—Limmared växer *Luzula luzuloides*, sannolikt insådd under banbygget kring sekelskiftet. *Tragopogon pratensis* hör även till de senare inkomlingarna och håller huvudsakligen till längs järnvägslinjerna och landsvägarna, där även *Bromus inermis* har sina rikaste förekomster. *Cynosurus cristatus* får knappast betraktas som indigen, utan är även den i likhet med *Bromus inermis* en sen inkomling. *Berteroa incana* har hittills huvudsakligen blivit sedd längs järnvägslinjerna, vilket även gäller *Erigeron canadense*, som tills dato endast noterats från Limmared och Ulricehamn.

Floran på och invid våra kyrkogårdar är merendels ganska enahanda, men understundom gör man även här intressanta fynd. Som regel gäller det då arter, som odlats i äldre tider. *Sedum spurium* är väl f. n. vår mest omhuldade kyrkogårdsväxt, och det finns väl

knappt en kyrkogårdsmur i Sjuhäradsbygden, som ej pryds av denna vackra succulent. Bland övriga finner man *Melandrium album*, som dock huvudsakligast förekommer inom de nordligare socknarna. Vidare ha vi *Aquilegia*, *Polemonium coeruleum*, *Medicago lupulina*, *Plantago media* och *Verbascum nigrum*. Huruvida de två sistnämnda möjligen odlats i äldre tider är svårt att avgöra, men i ett par av de sydligaste socknarna (Finnekumla, Månstad) har jag blott sett dem på kyrkogårdarna eller i deras omedelbara närhet. Härutöver har jag noterat *Ornithogalum* från Knätte, *Lamium album* från Dannike, Länghem och Sexdrega, *Saponaria* från Fivlered, Knätte och Kärråkra, *Leonurus cardiaca* från Marbäck, *Viola odorata* från Hössna och *Alchemilla alpina*[1] från Äspered. Vad orsaken kan vara till att *Hyoscyamus* nästan uteslutande är sedd vid kyrkogårdarna, har jag ej lyckats utröna. Kan även denna art möjligen i äldre tider ha varit föremål för odling? Intressant förefaller mig *Cystopteris fragilis*' och *Carex contigua*'s stora frekvens vid kyrkogårdarna, där den förra sällan saknas mellan stenarna i kyrkogårdsmurarna.

9. Kommentarer till artförteckningen.

Som jag inledningsvis antydde, är huvudsyftet med detta arbete att söka klarlägga de calcifila kontinentala och nordliga arternas sydgräns i Sjuhäradsbygden, d.v.s. hur långt de från sitt rika utbredningsområde i centrala Västergötland, enkannerligen Falbygden, tränga ned i oligotrofområdet i landskapets sydligaste del. Under arbetet härmed ha mina anteckningar beträffande övriga arter svällt ut så, att jag funnit det lämpligt att söka åstadkomma en sammanfattande översikt över områdets flora. Huvudparten av det sammanbragta materialet baserar sig på mina egna iakttagelser. Härutöver har jag erhållit en hel del uppgifter från andra intresserade botanister, som äro eller varit verksamma i bygden, och bland vilka jag särskilt vill nämna följande:

Lantbrukare Uno Bergengren, Örsås	(UB)
Studeranden Ingemar Bergqvist, Kölaby	(Bgt)
Lektor Carl Bliding, Borås	(Bdg)
Läroverksadjunkt Axel Harpen, Göteborg	(Hpn)
Museiassistent Torsten Hasselrot, Stockholm	(TH)[2]

[1] Se Westfeldt 1926.

[2] Hasselrots insamlingar — huvudsakligen från Hällstad och kringliggande socknar — tillhöra numera Riksmuseet (S, jfr nedan), varför den ovan anförda beteckningen endast kommer till användning beträffande ej publicerade uppgifter utan beläggexemplar.

Köpman Filip Karlvall, Göteborg	(Kvl)
Lektor Folke Lundberg, Kungälv	(Ldg)
Studeranden Örjan Nilsson, Ulricehamn	(ÖN)
Kontraktsprost J. N. Nordholm, † 1931	(Ndm)
Seminarierektor Carl Sandberg, † 1944	(CSg)
Apotekare Gösta Svensson, Svenljunga	(GSn)
Köpman Bertil Tomtlund, Sexdrega	(Tld)

Av övriga tillämpade förkortningar hänvisar Rdb till Rudberg 1902 (jfr ovan), Kj till Kjellberg 1928, Old till Osvald 1923 och S & S samt S & W till Sandberg & Söderberg 1922, resp. Sandberg & Westfeldt 1939.

Jag har i möjligaste mån tagit del av den äldre botaniska litteraturen och vid i artförteckningen inarbetade äldre uppgifter har även källan anmärkts. Då jag under en följd av år samtidigt med Kjellberg exkurrerat i bygden, har jag endast citerat Kjellberg i de fall, då jag själv ej sett arten på av honom angiven lokal. Egna i tidigare arbeten publicerade fynd äro medtagna, i regel dock utan källhänvisning.

Slutligen har jag genomgått de botaniska samlingarna vid Göteborgs Botaniska Trädgård (G), Riksmuseet (S) och Borås Högre Allmänna Läroverk (B). Genom professor H. Weimarcks benägna förmedling har jag erhållit en del lokaluppgifter från herbariet vid Botaniska Institutionen i Lund (L). I våra offentliga herbarier, speciellt det i Göteborg, finns ett stort antal ark insamlade av A. O. Olson. Denne är känd av alla äldre botanister från växtbytena i Lund och Uppsala kring sekelskiftet, och hans ingående kännedom om floran i Toarp och kringliggande socknar framgår tydligt nog av alla de i lokalförteckningen anförda fynden, speciellt från Toarp, Ljushult och Hillared, där ett (G) nära nog 100-procentigt anger, att Olson gjort insamlingen. Dessvärre lämnade Olson även material från odlade och förvildade exemplar utan att alltid på etiketten ange att så var fallet, vilket gör att man tvingas ställa sig synnerligen skeptisk mot en del av hans fynd och då i synnerhet beträffande insamlingar från Toarp: Bygd eller St. Bygd. Härutöver ha lektorerna Hård och Sterner lämnat mig utdrag ur registren till kartorna i sina gradualavhandlingar.

I Göteborgs Botaniska Trädgårds herbarium ligga en del ark, som äro insamlade under åren 1905—06 av Sten och Stina Ahlgren. Då etiketterna endast äro försedda med anteckningen »Ulricehamn», och arken även i övrigt göra intryck av att ha ingått i ett skolher-

barium, vilket jag även fått bestyrkt av en anförvant till insamlarna, ha arken konsekvent lämnats utan avseende.

Av egna dubblettexemplar, som överlämnats till våra offentliga herbarier, återfinnes flertalet i Göteborgs Botaniska Trädgårds samlingar.

Av utrymmesskäl har jag i regel endast angivit, i vilka herbarier beläggexemplar föreligga, medan insamlarens namn utelämnats. Den intresserade har ju då genom herbariehänvisningen möjlighet till närmare efterforskningar.

Lokalerna äro i förteckningen sammanförda sockenvis, varvid jag bortsett från den sentida storkommunindelningen och bibehållit de gamla sockennamnen. Till Ulricehamn hänföras blott de fynd, som äro gjorda inom det äldre stadsområdet; Brunn och Vist bibehållas alltså som fristående enheter. Jag har dessutom för att ernå större överskådlighet sammanfört socknarna häradsvis. De ha därvid så långt möjligt ordnats från N till S. Beträffande Redväg har jag låtit ett tankestreck avgränsa lokalerna i själva Ätradalen från dem inom häradets östra hälft. Däremot äro lokalerna inom socknarna alfabetiskt ordnade. Ås härads båda västligaste socknar, Brämhult och Gingri, ha helt uteslutits.

Jag är medveten om, att det finns luckor i förteckningen. Några släkten såsom *Alchemilla*, *Callitriche*, *Hieracium* (utom *H. aurantiacum*), *Rosa* och *Taraxacum* ha helt lämnats åsido. Beträffande vissa relativt vanliga växter äro lokaluppgifterna givetvis långt ifrån fullständiga, men jag har föredragit att omnämna de få säkra förekomsterna framför att tillgripa sådana ± diffusa begrepp som »flerstädes» etc. I en del fall har jag låtit en siffra efter sockennamnet angiva antalet kända förekomster inom ifrågavarande socken. Allmän har jag eljest betecknat en växt, som förekommer på flera lokaler i samtliga socknar; t. allmän en sådan som är flerstädes företrädd i de flesta. Ett utropstecken efter en förkortning inom parentes t. ex. (Bdg!) anger, att jag själv varit i tillfälle kontrollera uppgiften i naturen. »Ulricehamn 1782» anger att uppgiften är hämtad ur Winboms doktorsavhandling (jfr sid. 652), samt att arten ej anmärkts härifrån under senare tid.

Hybrider ha endast omnämnts i mycket begränsad omfattning (inom släktena *Potamogeton* och *Salix* ha sålunda inga dylika medtagits).

Nomenklaturen följer beträffande kärlväxter och mossor i huvud-

sak Lunds Botaniska Förenings »Förteckning över Skandinaviens växter» (1941, resp. 1937).

När jag till sist riktar mitt tack till alla dem, som varit mig behjälpliga under arbetets gång, vänder jag mig i första hand till professorerna G. Einar Du Rietz och J. A. Nannfeldt, som båda beredvilligt lämnat mig råd och vägledning vid arbetets redigering och finansiering. Museiassistent Torsten Hasselrot har jag att tacka för kritisk genomgång av manuskriptet samt för värdefull hjälp i redaktionella frågor. Stor tack är jag även skyldig fil. dr Carl Blom (Göteborg), som med aldrig svikande välvilja varit mig behjälplig vid bestämning av mera kritiska arter. Fil. dr Herman Persson (Stockholm) och docent Nils Albertson (Uppsala) ha benäget granskat mossorna, med undantag av dem från *Saussurea*-kärret i Brunn, vilket inventerats av apotekare Ivar Söderberg (Växjö) i mitt sällskap sommaren 1953. Ett varmt tack riktar jag även till min gode vän Martin Svensson (Borås), som åtföljt mig på mången givande exkursion över förrädiska gungflykärr.

För tryckningskostnaderna har anslag erhållits från Statens Naturvetenskapliga Forskningsråd.

10. Artförteckning.

Lycopodium selago. — *Redväg.* Dalum: Vinsarp. Vist: Vistberget. Brunn: Kälkared. — Kölingared (Kj). Strängsered: Komosse, Torhult. *Kind.* Tvärred: Hult, Ruggebo. Länghem: Djurgården. Marbäck: Bredgården. S. Säm: Sandslätt (Kj). Ljushult: Kovra. *Ås.* Hällstad: Hällstadmossen, Kyrkoskogen (TH), N om prästgården, Skogsslätt (TH), St. Björken. Fänneslunda: sjöarna. S. Ving: Säby. Rångedala: bäcken nedom Algutstorp, Marsjön. Toarp: Brattelid (B), Bygd (S, U), Djupedal (G, S), Ekås (G), Germundared (CSg), Holjemossen (S), Lindås (G), Målsryd (G), Nygård (CSg), Slätthult (id.) (G).

L. inundatum. — *Redväg.* Brunn: Brunnsnäs (U). *Kind.* Gällstad: Rånnavägsjön. Ljushult: Klerhults mosse (G, S). Hillared: Mölnered. Sexdrega: Hagalundsjön (Hpn). *Ås.* Rångedala: Marsjön. Toarp: Bråthult (S), Lilleve (CSg).

L. annotinum. — Allmän.

L. clavatum. — Allmän.

L. complanatum ssp. ***anceps***. — *Redväg.* Timmele: mell. Alarp o. Bjättlunda, Gryteskog, Röstesjön. Brunn: Kälkared. — Liared: Tuskan (Ndm). Gullered: Ekesbo (id.). *Kind.* Tvärred: Dumbäcken. Dannike: Ramsjön (S), Spättholmen (GSn). Marbäck: Korpebo. Ljushult: Ekorrsjön (S), Skanssjön (B, S). *Ås.* Murum: Årred. Hällstad: Kyrkoskogen

1,5 km NO om Djupedal, Lövåsen (Rökebo), Snugge. Grovare: Kvarnagärde (A. O. Olson enl. Ldg), SV om Sjögården (id.). Härna: V om Anksjön. S. Ving: Fäbroarna, Sjöslätt, Säby. Toarp: N om Berget, mell. Berget o. Nygårds mosse (S), Bråthult (B, S), mell. Bygget o. Holjemossen (S), Ekås (CSg), Germundareds skog (S), Gånghester (S & S), Holjemossen (G), Kronäng, Kulla vid Alelund (S), Kullakvarn (G, S), Målsryd, Rullkvarn (G), Skårs skog (S), Stålarp, Tjärnsjö (G, S).

Isoëtes lacustris. — *Redväg.* Dalum: Vinsarpsjön (Kj). — Liared: Oset (Kj). Gullered: Strängseredsjön. Strängsered: Komosse (Old), Strängseredsjön. *Kind.* Sämsjön o. Åsunden. Ljushult: Skanssjön (G, S). *Ås.* Mogden o. Tolken. Rångedala: »ån» (S) (Kj).

I. echinospora. — *Redväg.* Åsunden (U). — Gullered o. Strängsered: Strängseredsjön (Ndm). *Kind.* Åsunden. Hillared: Såken (Hpn). *Ås.* Mogden o. Tolken.

Equisetum arvense. — Allmän.

E. arvense* × *fluviatile. — *Kind.* Ljushult: Roppered (U). *Ås.* Toarp: Målsryd (U).

E. silvaticum. — Allmän.

E. pratense. — Sällsynt. Ståndortsanteckningar saknas.

E. palustre. — Allmän.

E. fluviatile. — Allmän.

E. hiemale. — *Redväg.* Dalum: Krutbrännaregården (brinkarna samt V om jvgn), vid Silarpsbäcken, SV om Vinsarp. Timmele: Kattåkra, Källeberg, Nöre. Vist: Hössnavägen, N om Vistafors. Brunn: Röstesjön, Ö om Toppsjön (vid vägen), villastaden. — Böne: Hällunda. Hössna: Halla, Hössnatorp. Gullered: Ekesbo (Ndm), Sjögared (id.), vid gla skolan, S om Ängabo. *Kind.* Tvärred: Högagärde. Länghem: Torpa (näset). Marbäck: torpet Hästhagen (i bäckravin). Sexdrega: Björsjöberg (Hpn). Dalstorp: sjön NO om kkn. *Ås.* S. Ving: Bogakvarn, Sjögården. Tärby: Finnekumlasjön. Rångedala: Byttorp, Gravryd, Marsjön, Ormåsa. Toarp: Gånghester, Kilabro (G, S, U), Målsryd (G).

E. variegatum. — *Ås.* Tärby: Finnekumlasjön. Varnum: S om Marsjön (vägdike) (G, S), Marsjön vid Väla, Mellsjön, grustaget N om stn (G). Rångedala: Marsjön (gla åfåror) (G).

Ophioglossum vulgatum. — *Redväg.* Ulricehamn 1782.

Botrychium lunaria. — *Redväg.* N. Åsarp: Frugården, stn. Kölaby: Gärdet, Sverkilstorp, Tummarp. Humla: grusgrop invid vägen till Kölaby. Blidsberg: Dalakvarn, S om Deragården. Timmele: Annestorpsjön, Knuve, Lena, Nöre, pkt 178, 1, Rosendal (A. O. Olson enl. Ldg). Brunn: St. Ekered (ÖN). — Kölingared: Sandvik (Kj). Knätte: N om byn. Hössna: Kinnared. Gullered: utefter landsvägen (Ndm). *Kind.* Länghem: Sävsjön (ÖN). Hillared: Åsendal. Sexdrega: Björsjön (GSn), Kortö (Hpn). Dalstorp: Högalid (Kvl), Skantås. S. Åsarp: Oppensten (UB). *Ås.* Hällstad: L. Björken (TH), Pjukarp (vid skjutbanan) (TH). S. Ving: Backared, Bogakvarn, Fäbroarna. Varnum: Dållebo (Kj). Rångedala: Byttorp (G).

B. multifidum. — *Redväg.* Brunn: Brunnsnäs 1874 (S). Ulricehamn: gla vägen till Brunnsnäs 1874 (G), Strandängen 1869 (B). *Ås.* S. Ving:

Lottenborg (skogsmark), Mogden (norra stranden) (S). Varnum: Mellsjön (A. O. Olson). Toarp: vid Mellsåkern (Hpn). — Uppgifterna från Brunn o. Ulricehamn avse säkerligen samma lokal.

Osmunda regalis. — *Redväg.* Dalum: Vinsarp 1875 (G). — Solberga: Baggekvarn (G, L). — Dalumslokalen förefaller högst dubiös o. bör utgå. — Jfr Westfeldt 1953.

Pilularia globulifera. — *Redväg.* Gullered o. Strängsered: Strängseredsjön (Ndm, Bdg). *Kind.* Länghem: Gärdsjön (G, S). Hillared: Vekakvarn (Hpn).

Pteridium aquilinum. — Allmän.

Matteuccia struthiopteris. — *Redväg.* Timmele: dalen S om Kattåkra. Vist: 500 m S om Vistberget. Brunn: bokskogen vid Ekered, Kråkeboberg, L. Ekered, Långsered, Remma, St. Ekered. Ulricehamn: Lindängen, S om stadsparken (ÖN). — Kölingared: Valshalla. *Kind.* Tvärred: Hjärtsbo, SV om kkn, Rude, Röshult, N om Tvärredslund. Dannike: Rölle, Stenshult, Stuvhult. Finnekumla: Fästered. Marbäck: Korpeboberg, Källebacka, Kärrabo, NO om Stensered, ravinen SV om Åsen. S. Säm: Attorp, Bossgården, Klevaberget, torpet Viken. Sexdrega: Götshult, Sandsjönäs, Slätthult (G). *Ås.* Fänneslunda: Kullatorp, Solberga. S. Ving: Björnkällan, Ekeslunda, Hästhagen, Hökerum, Kärr (S), Sjöbredared, Trogared, Tångagärde, Töve. Varnum: Boarp, Nitta, Årnäs. Rångedala: Finnekumla, Gravryd. Äspered: Sjötorp, Sundholmen, Vatunga. Toarp: Berget (G), Drared, Gånghester, Häljared (G), Sjögården, Tullen (G). — Jfr Rosendahl 1913, 1916 *b* (ff. från Sexdrega o. Toarp).

Blechnum spicant. — *Redväg.* Dalum: Vång. Brunn: Brämmesås, mell. Gäla o. Hallen (ÖN), Skogen. Ulricehamn (Rdb). — Hössna: Halla. Gullered: Ekesbo (Ndm). Strängsered: Hattåsen (id.), Tokared (Nils Törnqvist). *Kind.* Tvärred: Korpetån (B). Dannike: Stenshult (G). Marbäck: mell. Korpebo o. Näsboholm (ÖN). Ljushult: Dalen, Lövshult, Sävshult. *Ås.* Hällstad: Snugge, NO om St. Björken. S. Ving: Arnabo, Hökerum, mell. Hökerum o. Kärragärde (TH), Slätthult, Svederna, Öndared. Äspered: Blixnabb, Hinnaredsslätt, Hägnagärde, V om kkn, Lövaskog. Toarp: Ekås (S), mell. Ekås o. Myrås (G), Germundared (G), Häglared, Häljared, Labacken, Nygårds hage (G), Skårs skog (G), mell. Smedsås o. Stålarp, Tjärnsjön (B). — Jfr Rosendahl 1916 *b*.

Asplenium septentrionale. — *Redväg.* Humla: Drättekvarn. Timmele: Kattåkra, Mölnarp. Vist: Vistberget. Brunn: Brämmesås, Kråkeboberg, Åsakullen. Ulricehamn (G, S). *Kind.* Tvärred: Alhammar, Rude. Finnekumla: kkn. Marbäck: Bredgården. S. Säm: Klevaberget, Sandslätt (Kj). Hillared: Torsered. Roasjö: Nygården. *Ås.* Murum: Munkaberg, Skålarp. Hällstad: Brunstorp, Granared, kkn. Grovare: Avelsås, VSV om Sjögården. Härna: Sassarp. S. Ving: Ekeslunda, Sjöslätt. Tärby: kkn. Äspered: Arvidsgården, V om kkn. Toarp: Ekås, Germestorp, Germundared, Målsryd (S), Slätthult. — Flera former omnämnda från Toarp av Rosendahl (1913, 1916 *b*).

A. septentrionale* × *trichomanes. — *Ås.* S. Ving: Ekeslunda. Toarp: Målsryd (G).

A. trichomanes. — *Redväg.* N. Åsarp: Alvared, stn. Blidsberg: Kässeberg. Vist: Vistberget. Brunn: Kråkeboberg, Åsakullen. — Kölingared: Valshalla (S). *Kind.* Tvärred: Rude. S. Säm: Sandslätt (Kj). Grönahög (Kj). Hillared: bergsstup vid Såken, Torsered. Sexdrega: Björsjöberg. *Ås.* Hällstad: Granared. Grovare: Hule (A. O. Olson enl. Ldg), Högagärde, Sjögården. S. Ving: Ekeslunda. Toarp: Ekås (G), vid Mellsåkern, Målsryd (G, S), mell. Ramna o. Berget (G), Slätthult. — Flera olika former omnämnda från Toarp av Rosendahl (1916 *b*).

Athyrium filix-femina. — Allmän.

Cystopteris fragilis. — *Redväg.* N. Åsarp: Skägga. Humla: Drättekvarn. Blidsberg: Kässeberg. Dalum: kyrkbron, Vång. Timmele: Kattåkra, Nygården, Nöre. Vist: Fotåsen, Vistberget. Brunn: Kråkeboberg, Toppsjökullen, Åsakullen. Ulricehamn: Fredriksberg. — Kölingared: Valshalla, Årås (Kj). Böne: kkn. Liared: kkn, Ubbholmen. Gullered: kkn. *Kind.* Tvärred: Alhammar, Rude (S), Tvärredslund. Länghem: Kinnaliden, kkn, Torpa. Finnekumla: kkn. Marbäck: Näsboholm, Pedersbo, SV om Åsen. S. Säm: Attorp, Bossgården, Klevaberget. Gällstad: Intorp, Torsbo. Grönahög (Kj). Hillared: kkn, Mölnered, Såken. Sexdrega: kkn. Månstad: kkn. *Ås.* S. Vånga: kyrkoruinen. Möne: Rävike. Murum: kkn, Munkaberg (A. O. Olson enl. Ldg). Hällstad: Brunstorp, kkn. Grovare: Hule (A. O. Olson enl. Ldg), Högagärde (id.), kkn, Sjögården (A. O. Olson enl. Ldg). Fänneslunda: Karstorp. Härna: Sassarp. S. Ving: Romsås, Svederna. Tärby: kkn. Varnum: Nitta (B), Årnäs. Rångedala: Falskog (A. O. Olson enl. Ldg), »Klutabygget» (id.), Stenlid (id.). Äspered: kyrkbyn, Vatunga. Toarp: Berget (B), Djupedal (B), Ekås (S), Häljared, kkn, Lindås (B), Målsryd (B), Sjögårdssjön, Skinnarehult (S), mell. Skår o. Ramna, Tränghult (S). — Flera olika former omnämnda från Varnum o. Toarp av Rosendahl (1913).

Woodsia ilvensis. — *Redväg.* Vist: sågen, Ubbarp, Vistberget. Brunn: Brämmesås, Kråkeboberg, Åsakullen. — Liared: Skeppsholmen. *Kind.* Tvärred: Alhammar, Rude. Marbäck: Korpebo (ÖN). S. Säm: Klevaberget, Vegby. Grönahög (Kj). Hillared: bergsstup vid Såken, Torsered. *Ås.* Murum: Munkaberg. Hällstad: Brunstorp, Granared, kkn. Grovare: Hule (A. O. Olson enl. Ldg), kkn. Härna: Sassarp. S. Ving: Ekeslunda, Hökerum, Romsås, Svederna, Torp. Tärby: V om Väla skola. Rångedala: S om stn. Toarp: Berget, Germundared (G), Horsåssjön (G), vid Mellsåkern, Målsryd (G, S), Skinnarehult (G, S), Slätthagen (G), Slätthult.

[*W. alpina.* — *Ås.* Toarp: Målsryd (S), jfr sid. 675.]

Dryopteris filix-mas. — Allmän.

D. cristata. — *Kind.* Länghem: N om Fägerhult. Ljushult: Klerhults mosse (G, S). Sexdrega: V om Björsjön, Slätthult (Hpn), Tomten (id.). S. Åsarp: Hedåkra. *Ås.* S. Ving: mell. Ör o. Gärdsjön (mell. jvgn o. Viskan) (A. O. Olson enl. Ldg). Varnum: Nitta (Annelund) (id.). Toarp: Flage mader (G), Germundared, Gånghester (S & S), Lökared (G), Målsryd (B, S). — Jfr Rosendahl 1913.

***D. cristata* × *spinulosa*.** — *Kind.* Ljushult: Klerhult (G) (Rosendahl 1913). *Ås.* Härna: nära Anksjön (A. O. Olson enl. Ldg). Toarp: Flage mader (G), Målsryd (G).

***D. austriaca*.** — Sällsyntare än nästföljande.

***D. spinulosa*.** — Allmän.

***Lastrea thelypteris*.** — *Redväg.* Dalum: Tingvallakärret (G). *Kind.* Ljushult: Klerhults mosse (G). *Ås.* S. Ving: Bredsjön vid Linnet. Toarp: ön i L. Dalsjön (G) (Rosendahl 1913).

***L. phegopteris*.** — Allmän.

***L. dryopteris*.** — Allmän.

***Polypodium vulgare*.** — Allmän.

***Juniperus communis*.** — Allmän.

***Pinus silvestris*.** — Allmän.

***Picea abies*.** — Allmän.

f. ***virgata*.** — *Redväg.* Brunn: Gäla. — Hössna: Källeberg. *Kind.* Tvärred: Högagärde. Dannike: mell. Boanäs o. Lärjered. Hulared: Reutersberg. *Ås.* Härna: Anksjön. S. Ving: Kärr, Nygården, Röstesjön. Rångedala: V om Långaryd. Äspered: Nabben. Toarp: Gånghester, Målsryd (jfr Lundberg 1930).

***Typha angustifolia*.** — *Redväg.* Dalum: Viesjön. Timmele: Röstesjön. — Kölingared: Kölingsholm. Gullered: Sörsjön. *Kind.* Länghem: Haldarpsjön, Torpa (GSn). Finnekumla: Åsunden. Hillared: Hösjön (Hpn), Lagsjön. *Ås.* Hällstad: Björkensjöarna (S). Fänneslunda: Angsjön. S. Ving: Angsjön, Mogden, Viskan mell. Hökerum o. Gärdsjön. Varnum: Brogården, Kvarnagården. Äspered: Tolken vid Sundholmen.

***T. latifolia*.** — *Redväg.* Smula: Nya Fagerås. N. Åsarp: Fingerkvarn, Valundasjön, Åsen. Kölaby: Rynninge, Sverkilstorpsjön. Humla: Drättekvarn, N om kkn (Bdg), Smedsgården. Dalum: Flate, dike vid stn, Tingvallakärret. Timmele: Annestorp, Kattåkra, Kroksjöarna, S om kkn. Ulricehamn: nedom Lindängen, Åsunden. — Fivlered: kkn. Kölingared: kkn (Kj), St. Tåhult. Böne: S om Åfärd. Liared: vid kkn. Hössna: dike vid kkn, maderna Ö om kkn (Ndm). Gullered: Ätran S om kkn, jvgsdike 1 km V om Ubbared. *Kind.* Länghem: Djurgården, Rings mosse. Marbäck: jvgsdike S om stn (ÖN!). S. Säm: Fästered, Ramasjön, Sämsjön. Ljushult: Aplared. Hillared: sjön V om Torsered, jvgn vid Trollsjön. Sexdrega: Billeberg, Buttorp. *Ås.* S. Vånga: Åsen. Möne: Viesjön. Hällstad: Lursten, Älmestad. Grovare: N om Grosken. Härna: Gärdsjön. S. Ving: Angsjön, Aspanäs, Mogden, Tomta. Varnum: Brogården, Kyrksjön, stn, Tångabol, Tåsjön. Rångedala: Finnekumlasjön, ån N om kkn, Marsjön. Äspered: Gullestorpsjön, mossdike S om L. Äspered. Toarp: Dalsjöfors skola, vägdike V om Drared.

***Sparganium minimum*.** — T. allmän. Vanligast i *Kind.*

***S. Friesii*.** — *Kind.* Länghem: Gärdsjön (GSn). *Ås.* S. Ving: Mogden. Varnum: Marsjön (G) (S & S). Toarp: Sjögårdssjön (G).

***S. angustifolium*.** — *Ås.* S. Ving: Mogden. Toarp: Dalsjön (S), Kulla (S), St. Bygd (S). — Säkert flerstädes fast ej annoterad.

***S. angustifolium* × *simplex*.** — *Ås.* Toarp: Lindåssjön.

***S. simplex*.** — Allmän.

S. glomeratum. — *Redväg.* Gullered: byn (Ndm). *Kind.* Sexdrega: Buttorp (GSn). *Ås.* Grovare: Rya (CSg). Toarp: Balterna (G), Gånghester, Kulla (S), L. Bygd (G), Ottersmad (G), Tjärnsjöbäcken (G), Tokarpsskogen (G).

S. ramosum. — Allmän.

Potamogeton filiformis. — *Redväg.* Dalum: Viesjön (G, S). Timmele: Bredsjön (S). Jfr sid. 656.

P. pectinatus. — *Redväg.* Ulricehamn 1846 (S). Jfr sid. 655.

P. crispus. — *Redväg.* Humla: Drättekvarn. Blidsberg: Ätran vid kkn. Dalum: Platekvarn, Vinsarpsjön. Timmele: Bredsjön, Ö om stn (i Ätran) (TH). Vist: Ätran. Ulricehamn: Åsunden, Ätran. — Kölingared: Lönnern. Böne: Ätran. Gullered: Sörsjön (Ndm). *Kind.* Tvärred: Tolken vid Handvik (Ldg). Finnekumla: Sundet. Marbäck: Åsunden. S. Säm: Iglasjön (Tld). *Ås.* Hällstad: Björkensjöarna. Grovare: Grosken. Härna: Gärdsjön. S. Ving: Angsjön, Mogden. Säbybäcken. Varnum: sjöarna (S & S).

P. zosterifolius. — *Redväg.* Timmele: Bredsjön. Brunn: Röstesjön. *Ås.* Hällstad: St. Björken (CSg). Härna: Gärdsjön. S. Ving: Angsjön, Mogden. Varnum: sjöarna (S) (S & S).

P. obtusifolius. — *Redväg.* Dalum: Platekvarn, Vinsarpsjön. Ulricehamn: Åsunden (S). *Ås.* Hällstad: Igelsjön, Björkensjöarna (S). Härna: sjöarna (S & S). S. Ving: Mogden. Varnum: sjöarna. Äspered: Tolken. Toarp: Sjögårdssjön (G).

P. pusillus. — *Redväg.* Kölaby: Trädet i Ätran. Dalum (Rdb). Timmele: bäcken från Annestorpsjön, Ätran. Brunn: Röstesjön. — Böne: Åfärd i Ätran (B). Hössna: Valared (Ndm), Önnarp (id.). *Kind.* Hillared: Gälared. Månstad: stn. S. Åsarp: stn (Kj). *Ås.* Hällstad: mell. Skattegården o. Åsen (S). Härna: Gärdsjön. S. Ving: Angsjön, Mogden, Nygården, nära Röstesjön, Säbybäcken. Varnum: Årnässjön (CSg). Rångedala: Finnekumlasjön. Toarp: Gånghester (S & S), Styckesjön (G), Tjärnsjö (B).

P. alpinus. — *Redväg.* Ulricehamn: Ätran. — Kölingared: Tidan (Kj). Böne: Åfärd. Liared: Bergabron (Ndm), Tidan (id.). Hössna: Önnarp. *Kind.* S. Säm: Ramasjön. Ljushult (S). Hillared: Hinnared, Mölnered. *Ås.* Möne: dike till Ömmern (S). Murum: bäcken från Igelsjön Ö om Kyrkeberg (S). Hällstad: tillflöde till L. Björken (S). Härna: Gärdsjön. S. Ving: Angsjön, Mogden, Säbybäcken. Varnum: Käringsjön, Marsjön (S & S), kanalen mell. Marsjön o. Mellsjön. Äspered: Gullestorpsjön. Toarp: Gällsjö (S).

P. oblongus. — *Redväg.* N. Åsarp: Valundasjön. — Knätte: Igelsered. Hössna: St. Fagrared. Gullered: Sjögared (Ndm), Tissered (id.), Ubbareds by. Strängsered: Komosse (Old), Tokared (Kj). *Kind.* Gällstad: Lid, Påbo. Grönahög o. Ölsremma: Komosse (Old). Ljushult: Backa (Rdb), Gränd (G, S). Hillared: Hinnared, Åsendal. Sexdrega: Högen (G), mell. Kortö o. Brattåsen (GSn). Nittorp: Gölingstorp (Rdb). *Ås.* S. Ving: Kärrs nabb. Äspered: Lerbäck. Toarp: Brattelid (G), Bråthult (S), Bygd (B), Hallabromossen (G), Häljared (B), Kulla (B), Målsryd (Ldg), Tjärnsjö (G).

P. natans. — Allmän.

P. gramineus. — T. allmän.

P. lucens. — *Redväg.* Kölaby: Borred. Dalum: kyrkbron, Platekvarn, Vinsarp. Timmele: Bredsjön. Brunn: Röstesjön. Ulricehamn: Åsunden, Ätran. — Böne: Ätran. *Kind.* Tvärred: Sundet. Dannike o. Länghem: Ätran vid Forsa. Finnekumla: Åsunden. Hillared: Påtebo, stn. Sexdrega: Kortö (GSn), Ätran (G). *Ås.* Hällstad: Björkensjöarna (S), Bredsjön. Härna: Gärdsjön. S. Ving: Angsjön, Mogden. Varnum: Klevasjön (S & S), Kyrkarpsjön, Marsjön. Rångedala: Viskan.

P. praelongus. — *Redväg.* Dalum: Vinsarpsjön. Timmele: Ö om stn (i Ätran) (TH). Ulricehamn: Åsunden. — Kölingared: Jogen, Lönnern. *Kind.* S. Säm: Attorp (mindre sjö) (S), Sämsjön (Kj). Hillared: Hösjön (Kj), Såken. Ljungsarp: Lagmanshagasjön (Kj). *Ås.* Hällstad: Igelsjön (Degelius 1925), L. Björken (S). Härna: sjöarna (S & S). S. Ving: Angsjön, Mogden. Varnum: Marsjön, Mellsjön.

P. perfoliatus. — Allmän.

Triglochin palustre. — Allmän.

Scheuchzeria palustris. — *Redväg.* Gullered: Häggarpet (Ndm), Sörsjön (id.). Strängsered: Flärred (Ndm), Komosse (Old), St. Hästhagen. *Kind.* Länghem: Angsjön, Björsjön, Dunsjön, Vassgården. Marbäck: Korpebo (ÖN). Gällstad: Toppåsa (id.). Grönahög o. Ölsremma: Komosse (Old). Hillared: L. Kvistdroppen, kärr Ö om sagda sjö. Sexdrega: Långsjön. *Ås.* Hällstad: Ömmern (S). Toarp: Häljasjö (G), Skräppesjön (G).

Alisma plantago-aquatica. — T. allmän.

[*Echinodorus ranunculoides.* — *Redväg.* Ulricehamn 1782. Jfr sid. 653.]

Butomus umbellatus. — *Redväg.* Blidsberg: Ätran vid kkn. Dalum: Flate. Timmele: kyrkbron. Vist: bron vid kkn. Ulricehamn: i Ätran. *Kind.* Länghem: Strömmen. Hillared: Ätran vid stn (GSn) o. Veka (Hpn). Sexdrega: Buttorps kvarn (Tld) (utgången). *Ås.* Härna: Gärdsjön, Viskan vid Tissås. Rångedala: Finnekumlasjön, Marsjön.

Elodea canadensis. — Allmän i Viskans o. Ätrans övre lopp o. i sjön Åsunden[1]. F. ö. sedd vid: *Redväg.* N. Åsarp: Valundasjön. Kölaby: Sverkilstorpsjön. Dalum: Tingvallakärret. — Kölingared: Tidan, Vålleredsjön (Kj). *Kind.* S. Åsarp: ån vid Limmareds stn (Kj). *Ås.* Möne: Viesjön. S. Ving: Angsjön, Bredsjön. Rångedala: Rångedalaån.

Stratiotes aloides. — *Redväg.* Humla: Sörtorpet i Ätran. Blidsberg (Rdb). Dalum: Flatekvarn, Krutbrännaregården, Platekvarn, Tingvallakärret, Viesjöns avloppsdike (S). Timmele: Knuve, L. Kroksjön, Röstesjön. Vist (Rdb). Brunn: Röstesjön. Ulricehamn: gölen nedom Lindängen. *Kind.* S. Säm: Ramasjön [avser säkerligen samma lokal som Marbäck: Attorp (B, G, S) o. S. Säm: Kullabo (Kj)]. Sexdrega: Billeberg, Buttorp (Hpn), Lövdala (id.), sågen (id.). *Ås.* Möne: Ömmern (TH). Härna: Gärdsjön. S. Ving: Angsjön, avar vid Viskan. Varnum: Kyrkarpsjön, Marsjön (S), Mellsjön. Rångedala: Finnekumlasjön.

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[1] Rikligt blommande nedanför Sjö-Gunnarsbo i Marbäck 1925 (S).

Hydrocharis morsus-ranae. — Ätran i samtliga socknar från N. Åsarp till Åsunden. F. ö. i några smärre sjöhålor. *Redväg.* Dalum: Tingvallakärret, Viesjöns avloppsdike (S). Timmele: Annestorpsjön, Kroksjöarna. Ulricehamn: gölarna nedom Lindängen. *Kind.* Sexdrega: avar i Ätran. *Ås.* Möne: Viesjön, Ömmern (TH). Murum: Skålarp (TH). Varnum: sjöarna, Viskan vid stn. Rångedala: Klämmeström.

Setaria viridis. — *Redväg.* Ulricehamn (Rdb). *Kind.* Marbäck: kkn (ÖN).

S. italica. — *Kind.* Länghem: Haldarp 1935 (S & W).

Panicum miliaceum. — *Redväg.* Vist: nya sopstn.

Phragmites communis. — Allmän.

Phalaris arundinacea. — Allmän.

v. ***picta.*** — *Ås.* Fänneslunda: bäcken S om kkn. Toarp: Häljared, Tummarp.

Anthoxanthum odoratum. — Allmän.

Hierochloë odorata. — *Redväg.* Smula: bron över Skråern. N. Åsarp: Fingerkvarn, Valunda. Kölaby: Borred, Lundby vid Ätran (mkt rikl.). Dalum: Krutbrännaregården, 500 m N om kyrkbron, Silarpskullen, Viesjön (Arne Bergengren), Vinsarp, Ögården. Timmele: Bredsjön (S), Kroksjöarna, Nötekulla. Brunn: mell. Kråkebo o. kkn, L. Ekered. Vist: Vistaholm. Ulricehamn: vid garveriet (G), Prången (ÖN). — Solberga: Väberga kvarn. Kölingared: Ingared. Böne: Backgården, Björkås, Gamlegården, prästgården, Vinsarpsjön, Åfärd. Knätte: Jogen, kkn, Lönnern. Hössna: Halla, Oset. Gullered: Ekhult, Karlabo, Nolsjön, Tissered. Strängsered: Flärred. *Kind.* Marbäck: Björkered. Gällstad: Bystad, Intorp, Påtorp (S). Hillared: stn (G). Hulared: Grytteredsjön. *Ås.* Möne: mossen S om kkn, Torkilstorp, Viesjön (TH). Hällstad: Brunstorp, Djupedal, Gammalstorp (TH), Hof (S), Knapagården (TH), Kronogården, Lunden (TH), Sandslätt, Snugge. Grovare: Sjögården. Fänneslunda: Fänneslundasjön. S. Ving: Angsjön, Aspanäs, Hökerum, N om kkn, Mogden, Sjöslätt, Trogared, Töve (G). Tärby: korsväg Ö om kkn. Varnum: Mellsjön, stn. Rångedala: Klämmestorp. Äspered: Sjötorp. Toarp: Häljared, Taryd (vägkant).

Milium effusum. — *Redväg.* Brunn: Kråkeboberg, Åsakullen. Ulricehamn 1782. — Kölingared: Brängen 1870 (S), Valshalla (samma lokal som föregående?). *Kind.* Tvärred: Alshammar, Tvärredslund. Länghem: Hovsnäs (näset), Torpa. Marbäck: Korpeboberg, Näsboholm (ÖN). S. Säm: Klevaberget. Grönahög: Östentorp (Kvl!). *Ås.* S. Ving: mell. Bogakvarn o. Romsås. Rångedala: Gravryd. Äspered: Vatunga.

Phleum pratense. — Allmän.

Ph. nodosum. — *Redväg.* Dalum: stn 1953.

Ph. phleoides. — *Redväg.* Smula: 5 lok. N. Åsarp: 13 lok. Kölaby: 6 lok. Humla: 5 lok. Blidsberg: 9 lok. Dalum: 10 lok. Timmele: Knalten, Knuve, Nöre, stn. — Solberga: kkn, getryggen S om kkn. Fivlered: kkn. Böne: Hällunda, N om kkn. Knätte: kkn, åskullarna 500 m S om kkn. Liared: N o. S om kkn, Skeppsholmen. Hössna: Holmarp, Hössnatorp, Kinnared, kkn, Torpet. Gullered: S om kkn. *Kind.* Marbäck: kkn (S), Storegården (idrottsplatsen). Sexdrega: Buttorp (G).

Ås. Kärråkra: åsen vid kkn, Ryagärde. Möne: Sjöarp. Hällstad: Gammalstorp, Älmestad (S). Fänneslunda: Karstorp. S. Ving: Säby, Töve. Varnum: Bossgården, Kvarnagården, S om kkn, Tångabol. Rångedala: Dränggården. — Karta (fig. 3).

Alopecurus myosuroides. — *Ås.* S. Ving: Hökerums stn 1925.

A. pratensis. — Allmän.

A. geniculatus. — Allmän.

Agrostis stolonifera. — Allmän.

A. gigantea. — *Redväg.* Dalum: Silarp. *Kind.* Länghem: Torpa. *Ås.* Äspered: Hägnagärde.

A. tenuis. — Allmän.

A. canina. — Allmän.

Calamagrostis epigeios. — Allmän.

C. purpurea. — *Redväg.* Timmele: Alarp, Bjättlunda, Brostorp, Redvägsborg (G). Brunn: Kråkeboberg, Åsakullen (G). Ulricehamn: Grönahögsvägen. — Hössna: Duvered (G). Gullered: S om byn (G), Karlabo, 1 km V om Ubbared. *Kind.* Tvärred: Dumbäcken, Högagärde. Länghem: Hökasjön (G). S. Säm: Klevaberget. Gällstad: St. Bystad. Hillared: Lagsjön. Roasjö: Påbol (vid bäcken). *Ås.* Hällstad: St. Björken. S. Ving: Tolken (G). Varnum: Kvarnagården, Väla. Äspered: Vatunga (vid Tolken). Toarp: Bygd (G), Gånghester (S), Madåkra (G), Tränghult (B).

C. canescens. — *Redväg.* N. Åsarp: S om jvgsbron. Blidsberg: längs Ätran på gränsen till Dalum. Dalum: stn, Vinsarp. Timmele: Nygården. Vist: Ubbarp. Brunn: Hede, Kälkared, L. Ekered. Ulricehamn: Oset, stn. — Kölingared: Söre, Årås. Böne: Björkås. Knätte: Köpmantorp. Liared: Gravsjö. Hössna: Brunsered. Gullered: Karlabo, 2 km V om Ubbared, Vitsand. Strängsered: Komosse (Old), Näshult, Torhult. *Kind.* Dannike: Rölle. Länghem: Björsjön, Borgesjön, Djurgården, Hovsnäs, Torpa. Marbäck: Kärrabo, Stensered. S. Säm: Klevaberget, Svedjorna. Gällstad: Bystad. Grönahög: Vrångestorp, Åsbjörntorp. Hillared: Hösjön, Åsendal. Månstad: Björdal. Hulared: Grytteredsjön. S. Åsarp: Ladugården. *Ås.* Möne: Torkilstorp. Murum: Kyrkeberg. Hällstad: St. Björken. Grovare: Grosken. Fänneslunda: Solberga. Härna: Justinsberg, Örsjön. S. Ving: Angsjön, Aspanäs, Hökerum, Mogden, Tolken. Varnum: Kvarnagården. Rångedala: Byttorp, Gretlanda. Äspered: Hallabrolid, Vatunga. Toarp: Andared, Drared, Häljasjö (G, S), N om Målsryd, Sjögårdssjön, Skäftingsbacka, Taryd.

C. canescens* × *neglecta. — *Ås.* S. Ving: Aspanäs vid Mogden (G). Varnum: jvgsbanken vid Kvarnagården (G). Äspered: Vatunga (vid Tolken).

C. canescens* × *purpurea. — *Ås.* Hällstad: Djupedal (S).

C. neglecta. — *Redväg.* Smula: vid bron över Skråern. N. Åsarp: Alvared, Fingerkvarn, Hansagården, prästgårdskärret, Valundasjön. Kölaby: Näbbarp, Sverkilstorp. Humla: Smedsgården, Väddåkra. Blidsberg: utmed Ätran. Dalum: Flate, Krutbrännaregården, kyrkbron, Nöresjön, Tingvallakärret, Vinsarpsjön. Timmele: Klockaregården, Kroksjöarna, V om stn. Vist: vid Åsunden. Brunn: Brunnsnäs. Ulrice-

hamn: Lindängen. — Kölingared: Hemryd, Ingared, Kölingsholm, vid Lönnern. Böne: Backgården, NV om kkn, Åfärd. Knätte: byn, Marbohemmet. Gullered: N om byn, Vitsand. *Kind.* Tvärred: Alhammar. Dannike: Åsunden vid Boanäs. Länghem: Forsa (Bdg). Marbäck: Åsunden. S. Säm: Klevaberget. Hillared: Hinnared, Hökasjön. Roasjö: Roasjö. Ljungsarp: Stomsjön. *Ås.* Möne: Viesjön. Murum: Aplaberg. Hällstad: Björkensjöarna (S), Hof. Grovare: Grosken. Härna: vid Viskan, Örsjön. S. Ving: Angsjön, Mogden (S), Nygården, Sjöslätt, Tångagärdshage (vid Tolken). Tärby: Finnekumlasjön. Varnum: Kvarnagården, Marsjön. Rångedala: Marsjön. Äspered: Sjötorp, Sundholmen (G), Vatunga. Toarp: Sjögårdssjön.

C. arundinacea. — T. allmän.

Apera spica-venti. — *Redväg.* Timmele: Alarp. Brunn: Hede. — Hössna: Ö om kkn (1954) (ÖN). *Ås.* Kärråkra: vid kkn. S. Vånga: Backabo. Hällstad: Ambo, Halanda. Härna: Nitta, Sassarp, Åstorp. S. Ving: Getared, Nollyckan. Toarp: Bygd (G).

Holcus lanatus. — T. allmän.

H. mollis. — *Kind.* Marbäck: Vackebacka (ÖN). Hillared: N om kkn. Hulared: Stålared. *Ås.* S. Ving: Kärr. Äspered: Vatunga. Toarp: Skår (G), Skårsgärde (G).

Deschampsia caespitosa. — Allmän.

D. flexuosa. — Allmän.

Avena elatior. — Insådd. T. allmän.

A. pratensis. — Allmän.

A. pubescens. — T. allmän.

A. strigosa. — *Redväg.* Kölingared 1870 (S). *Ås.* S. Ving: Tångagärde (S & S).

Trisetum flavescens. — *Redväg.* Kölingared: kkn (Kj), Kölingsholm. Hössna: prästgården (Ndm). Gullered: Hästhagen (id.). *Ås.* Äspered: Lövaskog.

Sieglingia decumbens. — T. allmän.

Melica nutans. — T. allmän.

Molinia coerulea. — Allmän.

Catabrosa aquatica. — *Redväg.* Ulricehamn 1782. — Knätte: Knätte kvarn (Kj!). *Kind.* Finnekumla: Fästered (Kj). *Ås.* Hällstad: Hof (G, S), Väby (Rdb).

Briza media. — Allmän.

Dactylis glomerata. — Allmän.

Cynosurus cristatus. — *Redväg.* Brunn: Kråkebo. Ulricehamn. — Kölingared: Kölingsholm. Hössna: Önnarp. *Kind.* Tvärred: gla kyrkogården. Finnekumla: Fästered. Marbäck: kyrkogården. Gällstad: Frölunda. Ölsremma: Grebbaslätt. *Ås.* Hällstad: Hof, kkn, prästgården (S). S. Ving: Bogakvarn. Varnum: Dållebo. Äspered: Hägnagärde, Vatunga. Toarp: Hjortryd. — Antagligen insådd.

Poa Chaixii. — *Kind.* Hillared: Åsendal (gla stn) (S & W).

P. remota. — *Redväg.* Kölingared (Rdb). *Kind.* S. Säm: Klevaberget (G). *Ås.* Rångedala: Gravryd (S). — Har ej kunnat återfinnas i Kölingared. Jfr Holmberg 1922.

P. pratensis. — Allmän.

P. nemoralis. — Allmän.

P. palustris. — *Redväg.* Humla: Väddåkra. Dalum: Vedåsa, Viesjön. — Kölingared: Sandvik. *Kind.* Dannike: Forsa. *Ås.* S. Ving: Mogden vid Vätersholm. Varnum: Kvarnagården. Äspered: Vatunga.

P. compressa. — *Redväg.* N. Åsarp: Frugården, Långekra, stn. Kölaby: Trädets gård, Tummarp. Timmele: stn. Brunn: jvgn. Ulricehamn: stn. *Kind.* Marbäck: jvgn vid stn o. Korpeboberg. Ljushult: Mariedal. Månstad: stn. *Ås.* Kärråkra: kyrkbyn. Hällstad: kkn. S. Ving: Mogden, Nygården, Röstekärr. Varnum: Kvarnagården, Varnumssjöarna. Toarp: Nygårds mosse (banan) (G, S).

P. trivialis. — Allmän.

P. supina. — *Redväg.* Vist: nedom Vistberget (det. E. Asplund). — Hössna: Hössnatorp (det. id.). *Ås.* S. Ving: Mogden nedom Nygården (det. J. A. Nannfeldt).

P. annua. — Allmän.

Glyceria fluitans. — Allmän.

G. maxima. — *Redväg.* Smula: Breskekvarn, i Ätrans gla fåra. N. Åsarp: Alvared, Skäggakvarn, Vingeskvarn. Humla: Drättekvarn, Smedsgården, Sörtorpet, Väddåkra. Dalum: Vinsarpsjön. Åsunden i Vist, Brunn o. Ulricehamn. — Kölingared: Kölingsholm, Årås. Böne: Ätran. *Kind.* Länghem: Haldarpsjön. Marbäck: Åsunden. Ljushult: Frisjön (G), Skanssjön. *Ås.* Toarp: Sjögårdssjön.

Festuca altissima. — *Redväg.* Brunn: Kråkeboberg (G). — Se vidare Westfeldt 1947.

F. ovina. — Allmän.

F. trachyphylla. — Stundom insådd. Lokaluppgifter saknas.

F. rubra. — Allmän.

F. pratensis. — Allmän.

Lolium temulentum. — *Redväg.* Ulricehamn 1782. *Ås.* S. Ving: Håkabo 1925, Hökerum 1925, Nollyckan 1923. — Ej sedd i senare tid.

L. perenne. — Allmän.

Nardus stricta. — Allmän.

Bromus inermis. — *Redväg.* Dalum: Rom. Timmele: Kroken, S om kkn. Ulricehamn: södra stadsdelen, stn. — Hössna: Valared. *Kind.* Tvärred: Tvärredslund. Länghem: gla fotbollsplanen, Haldarp. S. Säm: Vegby. Hillared: Hinnared. Sexdrega: kkn, vid bron över Ätran. *Ås.* Fänneslunda: mell. herrgården o. Karstorp, vid sjön. S. Ving: Hökerum. Varnum: Gälabo, stn, Strömshov, Väla. Rångedala: Klämmestorp, kkn. Toarp: Gånghester, kkn.

B. Benekeni. — *Redväg.* Brunn: Kråkeboberg (G). — Se vidare Westfeldt 1947.

B. tectorum. — *Redväg.* N. Åsarp: stn 1954. Dalum: Gustavsberg (jvgn), stn. *Ås.* S. Ving: Hökerums stn. Rångedala: kkn.

B. arvensis. — Allmän längs järnvägarna, f. ö. h. o. d. på sandig mark.

B. secalinus. — *Ås.* S. Ving: Hökerums stn.

B. hordeaceus ssp. ***mollis.*** — T. allmän.

Brachypodium pinnatum. — *Redväg.* Smula: L. Fagerås. N. Åsarp: Hagaberg, N om Hansagården (fuktig mark), N om Åsen. Blidsberg: vägskälet NV om Påarp (i kärr). Dalum: Krutbrännaregården, Ö om Lunnagården, brinkarna vid Platekvarn, vid bäcken S om Silarp, Silarpskullen, Svenstorp (moränkulle vid Ätran), N om Vångs by, Ögården. Timmele: Gryteskog (TH), Nötekulla, Yttre Vång. Brunn: vid bäcken mell. Kråkebo o. kkn (S), Kättsered, Långsered (fuktig mark, jfr tab. 1). Ulricehamn 1782. — Solberga: Baggekvarn (vid Ätran). Knätte: kullarna 500 m S om kkn. Hössna: Krokstorp, mell. Oset o. Önnarp (vid Ätran) (G). *Kind.* Marbäck: Hyared (vid bäcken), pkt 196, 4 (vid bäcken). *Ås.* Möne: Bengtsgården (fuktig mark). Hällstad: Lunden (i kärr), Lursten (fuktig mark). Äspered: Vatunga (vid Tolken). — Karta (fig. 3).

[*B. silvaticum.* — *Redväg.* Hössna: Önnarp (Holmberg 1926). — Lokalen skall utgå. Felbestämning. Avser *B. pinnatum.*]

Agropyron repens. — Allmän.

A. caninum. — *Redväg.* N. Åsarp: Ekeberga kvarn. Blidsberg: Dalakvarn. Dalum: Krutbrännaregården, Vinsarp. Timmele: Frännarp, Redvägsborg, Sjöbacka. Vist: Nyboholm. Brunn: Kråkeboberg, Kälkared, Långsered, Remma. Ulricehamn. — Solberga: Bogakvarn. Kölingared: Åråsa. Böne: Åfärd. Liared: kkn. Hössna: Krokstorp, Oset, Önnarp (S). Strängsered: Ögärdet. *Kind.* Tvärred: Alhammar, Hjärtsbo. Finnekumla: Sundet. Marbäck: Bredgården, vid bäcken genom byn, Bäckagården, Hyared, Kärrabo, pkt 196, 4, N om stn. S. Säm: Klevaberget, Vegby. Gällstad: Intorp. S. Åsarp: Oppensten. *Ås.* S. Ving: Bogakvarn, Haga, Lida, Mogden, Röstesjön, Sjöslätt, vid Tolken, Åkershult. Varnum: Nitta, Årnäs. Rångedala: Algutstorp. Äspered: Sjötorp, Sundholmen, Vatunga. Toarp: Målsryd (S), Toarpsdal.

Hordeum jubatum. — *Ås.* S. Ving: Aspanäs 1927, Hökerums stn 1925.

Eriophorum vaginatum. — Allmän.

E. angustifolium. — Allmän.

E. latifolium. — *Redväg.* N. Åsarp: 10 lok. Kölaby: Stommen. Humla: i norra delen av socknen, Haberget, S om kkn, Väddåkra. Blidsberg: 7 lok. Dalum: 8 lok. Timmele: 8 lok. Vist: Hester, Nyboholm, Ubbared. Brunn: Långsered, Remma, Toppsjön. Ulricehamn (Rdb). — Solberga: Baggekvarn, N om kkn. Kölingared: Baggekulla, Valshalla. Böne: Hällunda, sankmarker NV om kkn, S om Vinsarpsjön, Åfärd. Knätte: 500 m N om byn, Igelsered, Lunds by, Långsered. Liared: Bergabron, Brännered, N om Gudebo, Holmåker, N om kkn, Prästryd, Ubbholmen. Hössna: Björkelund, Hillared, Hule, Ö om Hyåsen, Krokstorp, Önnarp. Gullered: Backen, Boared, Nolsjön, Sjögared, Ubbared. Strängsered: Komosse, Tokared, Torhult. *Kind.* Tvärred: Hjärtsbo, Högagärde. Dannike: Rölle. Länghem: Angsjön, Djurgården. Finnekumla: Fästered (Kj). Marbäck: Bäckagården, Hyared, Källebacka, pkt 196,4. S. Säm: Ramasjön. Gällstad: Götåkra. Grönahög: Ingeshult, Komosse (Old), Kvarnared. Ölsremma: Grebbaslätt. Hillared: Texlemossen, Åsendal o. mossen V därom. Sexdrega: Björsjön, mell. Brattås

o. Rörås (GSn), Sandsjönäs. Dalstorp: Sånarp. S. Åsarp: Sjörred. *Ås.* Kärråkra: Boarp. S. Vånga: mell. Murum o. Vånga, Åsen. Möne: Bengtsgården, Bolstorp, Östergården (S). Murum: kkn. Hällstad: 8 lok. Fänneslunda: herrgården. Härna: vid Gärdsjön. S. Ving: 7 lok. Tärby: Ö om kkn. Varnum: Kvarnagården. Rångedala: Finnekumla, Gretlanda. Äspered: Sjötorp, Vatunga. Toarp: Bygd, Germundared, Häljared, Sjögårdssjön.

E. gracile. — *Kind.* Länghem: Angsjön (G), S o. N om Dunsjön. Sexdrega: mell. Brattåsen o. Rörås (GSn), Hestrasjön (id.) (L). *Ås.* Toarp: Skräppasjön (G).

Scirpus silvaticus. — Sällsynt i de nordligare socknarna. *Redväg.* N. Åsarp: Fingerkvarn. Blidsberg: Björnarp. Dalum: 8 lok. Timmele: 6 lok. Vist: 5 lok. Brunn: 4 lok. Ulricehamn: Lindängen. — Solberga: N om kkn. Kölingared: Hemryd, kkn, Sandvik. Böne: N om kkn, vid Lönnern. Liared: Holmåkra. Hössna: 8 lok. Gullered: Backen (Ndm). *Kind.* Tvärred: Häståsen, Majblomman. Dannike: Rölle. Finnekumla: Fästered. Marbäck: 6 lok. S. Säm: Attorp, Bossgården, Vegby. Gällstad: 6 lok. Grönahög: Vrångestorp. Ölsremma: Grebbaslätt. Sexdrega: Björkås, Handbynäs. Dalstorp: Älmås. Hulared: Stålared. *Ås.* Möne: Östergården (TH). Hällstad: Djupedal (TH). Fänneslunda: herrgården, Kartryd. Härna: Gärdsjön. S. Ving: 8 lok. Varnum: Dållebo, Kvarnagården. Rångedala: Algutstorp, Gretlanda, prästgården, ån vid stn, Torsbro. Äspered: Sundholmen, Vatunga. Toarp: Bygd, Germundared (G), Långhult, Lökared (G), Myrås (S), Sjögårdssjön.

S. lacustris. — Allmän.

S. planifolius. — *Redväg.* N. Åsarp: Dörragården. Kölaby: Sverkilstorp, Tåstarp. Dalum: 1 km S om Silarp, SV om Vinsarp. Timmele: Brostorp, Lena, Nötekulla, Torvås, Vång. Brunn: Brunnsnäs. — Kölingared: pkt 279, 8, Stensered. Böne: Lönnarp (Rdb), N om Åfärd. Knätte: Ätran vid byn. Liared: kkn. Hössna: kärret Ö om kkn, Oset, Önnarp. Gullered: Ätran vid kkn, Tissered (Ndm). Strängsered: Vriö (id.). *Kind.* Dannike (F. Swalander). Länghem: Gärdsjön (G, S). *Ås.* Hällstad: L. Björken (S), Påvagården, Salunda, SV om Skattegården (S), Åsen. S. Ving: Bogakvarn. Toarp: Häljareds flogar (G).

S. pauciflorus. — *Redväg.* N. Åsarp: Alvared (G, S), prästgårdskärret. Dalum: Krutbrännaregården, Svenstorp, Viesjön, Vinsarpsjön. Timmele: Brostorp. — Kölingared: Sandvik. Böne: Åfärd. Hössna: mell. Krokstorp o. Valared, kärret Ö om kkn. Gullered: Ekesbo (Ndm), Sjögared (id.). Strängsered: Komosse (Old). *Kind.* Tvärred: Högagärde, Ruggebo. Länghem: Angsjön, Sävsjön. Marbäck: skärningen vid Korpeboberg. S. Säm (S) (Kj). Gällstad: Rånnavägsjön. Grönahög: Komosse (Old). Ljushult: Aplared (Bdg), Lysjön, Skanssjön (G, S). Sexdrega: Dalen (Hpn), Handbynäs (id.), Ryasjö (id.). Månstad: Tapplesjön. Hulared: Grytteredsjön. Ljungsarp: S om Pajet. *Ås.* Kärråkra: kkn. Möne: Viesjön (S). Hällstad: Björkensjöarna (S), Bredsjön, Katthög, Lunden (TH). Härna: Gärdsjön. S. Ving: Angsjön, Fäbroarna, Mogden, Tolken. Varnum: sjöarna. Rångedala: Finnekumlasjön, Marsjön. Äspe-

red: Gullestorpsjön (G). Toarp: Bygd (Kilängen), Sjögårdssjön, Tjärnsjö (G).

S. acicularis. — *Redväg.* Dalum: Flatekvarn. Timmele: Röstesjön. Vist o. Brunn: Åsunden. Ulricehamn 1782. — Gullered: Nolsjön (Ndm), Sjögared (id.). *Kind.* Tvärred: Högagärde. Länghem: Angsjön, Torpa. Marbäck: Åsunden. S. Säm: Sämsjön. Sexdrega: Kortö i Ätran (GSn). Hulared: Grytteredsjön. *Ås.* Hällstad: Bredsjön. S. Ving: Mogden, Tolken. Varnum: sjöarna. Rångedala: Marsjön. Äspered: Tolken.

S. mamillatus. — *Redväg.* Kölaby: Tåstarp. Timmele: Klockaregården. *Kind.* Hillared: Såken vid Gälared (Hpn), Påtebo i Ätran. Sexdrega: Abborrsjön (id.), Hagalundsjön (id.). *Ås.* Murum: mell. Skålarp o. Sölvarp (S), Årred. Hällstad: Lursten. Varnum: Käringsjön, Mellsjön. Toarp: Lindås (G).

S. palustris. — Allmän.

S. uniglumis. — *Redväg.* Dalum: småsjöarna S om kkn, Viesjön (S). Timmele: Bredsjön. — Gullered: N om byn, Nolsjön vid Gudebo. *Kind.* Dannike: vid Åsunden. Länghem: Gärdsjön (G). Ljushult: Lysjön (G). Hillared: Gälared vid ån (Hård), Kinnared, Kärraholm, Såken. Hulared: Grytteredsjön. *Ås.* S. Ving: Sjöslätt. Varnum: mell. Marsjön o. Mellsjön. Rångedala: Marsjön (S & S). Äspered: Sundholmen. Toarp: Lindås (B).

S. multicaulis. — *Kind.* Ljushult (Holmberg 1922).

S. hudsonianus. — *Redväg.* N. Åsarp: Alvared, prästgårdskärret, Valundasjön. Kölaby: Sverkilstorp. Dalum: Tingvallakärret, Viesjön, Vinsarpsjön. Timmele: Lena. Brunn: Brunnsnäs, S om kkn (Kj), Röstesjön. Ulricehamn 1782. — Fivlered: Yttern. Kölingared: Baggekulla (S). Böne: S om Gamlegården. Knätte: Lunds by, Lönnern. Hössna: Brunsered, mell. Brunsered o. Önnarp, prästgården (UB), Torinstorpet. Gullered: 1 km V om Ubbared. Strängsered: Komosse (Old), S om St. Hästhagen. *Kind.* Tvärred: Dammsjön (Kj). Dannike: Boanäs. Länghem: Angsjön, Djurgården, Dunsjöbäcken, Hovsnäs (Kj). Finnekumla: Fästeredsjön (Hård). Marbäck: Bäckagården (Kj). S. Säm: Ramasjön. Grönahög o. Ölsremma: Komosse (Old). Hillared: Åsendal. Sexdrega: Buttorp, Hestrasjön (GSn, Hpn), Lövdalaaven (Hpn), Ryasjön. *Ås.* Möne: mossen S om kkn, Viesjön (TH), Ömmern (TH), Östergården. Hällstad: Hällstadmossen, Igelsjön (S). S. Ving: Mogden. Rångedala: Finnekumla. Äspered: Gullestorpsjön. Toarp: Häljared (S & S), V om kkn, Målsryd (B).

S. caespitosus ssp. ***austriacus***. — *Redväg.* N. Åsarp: mossen Ö om kkn. Dalum: Vinsarpsmossen. Timmele: Bredsjön, L. Kroksjön, Röstesjön. Brunn: Snipe (ÖN). Ulricehamn (Rdb). — Kölingared: Gunnered. Knätte: Lunds by. Hössna: mell. Brunsered o. Önnarp, L. Fagrared, Lönnåsen, Torinstorpet. Gullered: Karlabo, 2 km V om Ubbared. Strängsered: Komosse, St. Hästhagen. *Kind.* Tvärred: Bodarna, Ruggebo. Länghem: Angsjön, SV om Björsjön, Djurgården, Dunsjön, Ö om kkn. Grönahög: Komosse, Nordskogen. Ölsremma: Komosse. Ljushult: Aplared (Bdg). Hillared: Åsendal, V om Åsendal. Sexdrega: mell. Kortö o. Aspelund (GSn), Långsjön. Hulared: Grytteredsjön. *Ås.* Hällstad:

Hällstadmossen, Knapagården, St. Björken, Ömmern. Rångedala: Öna. Äspered: mossen SV om kkn. Toarp: Hagen (G), mossen N om Hallabron.

S. caespitosus ssp. ***germanicus***. — *Ås.* Toarp: mossen N om Hallabron.

Schoenus ferrugineus. — *Redväg.* N. Åsarp: Valunda. Kölaby: Sverkilstorp (övre sjön). Dalum: Vinsarp (dalen mot kkn), Vinsarpsmossen. — Hössna: Ö om Hössnatorp, Knutstorp, Krokstorp, Valared. *Kind.* Hillared: mossen V om Åsendal (G). *Ås.* Möne: mossen S om kkn (S). Hällstad: mell. Gisslarp o. Pjukarp. S. Ving: Angsjön (S). — Karta (fig. 5).

Cladium mariscus. — *Redväg.* Ulricehamn 1782. — Ej sedd i senare tid. Jfr sid. 665.

Rhynchospora alba. — Allmän.

Rh. fusca. — *Redväg.* Dalum: Vinsarp (G). Brunn: Toppsjön (G). — Gullered: Sjögared (Ndm), Sävsjön (id.). Strängsered: Komosse (Old). *Kind.* Länghem: Angsjön, Bredsjön (Hpn!), Dunsjöbäcken. Roasjö: Roasjön. Sexdrega: Lövdala (Hpn), mell. Ringestena o. Ringsås (GSn), Ryasjö (Hpn), Sandsjönäs (G). *Ås.* S. Ving: Angsjön. Toarp: Häljared (G), Lilleve (G, S), Sjögårdssjön (G).

Carex dioeca. — T. allmän.

C. pulicaris. — Allmän.

C. pauciflora. — *Redväg.* Brunn: Långsered. — Kölingared. Hössna: Torinstorpet. Gullered: Ekesbo (Ndm), 1 km V om Ubbared. Strängsered: Komosse, St. Hästhagen. *Kind.* Dannike: Ö om Boda. Länghem: Angsjön, Björsjön, Djurgården, S om Vassgården. Grönahög: Komosse, Nyarp, Vrångestorp. Ljushult: Aplared. Hillared: torpet Svederna. Hulared: SV om Grytteredsjön. Nittorp: Stockremma. Ljungsarp: Kättsjö. *Ås.* Hällstad: Hällstadmossen, Igelsjön (S), Ömmern. S. Ving: Säby. Tärby: Ässtorp. Äspered: Gullestorpsjön, mossen SV om kkn. Toarp: Drared (Kj). — Ej konsekvent antecknad.

C. appropinquata. — *Redväg.* Dalum: N om Plate, Vinsarpsmossen. Timmele: Redvägsborg. — Böne: NV om kkn, prästgården. Hössna: Önnarp. *Ås.* Hällstad: Gisslarp (S), Knapagården (S), Munkeboda (S). S. Ving: Hökerum (S). — [Lokalen Toarp: Gånghester (S & S) skall enl. Sandberg utgå. Felbestämning.]

C. diandra. — *Redväg.* Smula: vid bron över Skråern. N. Åsarp: Alvared (vid dansbanan), prästgårdskärret, Valundasjön. Kölaby: Sverkilstorp (sjöarna). Humla: Väddåkra. Dalum: Platekvarn, Silarp, stn, Tingvallakärret, Viesjön, Vång, Ätran nedom Silarp. Timmele: Annestorpsjön, Klockaregården, Kroksjöarna, mell. Lena o. Vång, Nygården, Ätran S om kkn. Vist: Snipesjön. Brunn: Brunnsnäs, Röstesjön (S), Toppsjön. Ulricehamn: Lindängen. — Kölingared: Tidan vid kkn. Böne: prästgården. Knätte: byn. Strängsered: Komosse. *Kind.* Länghem: Angsjön, Bredsjön. Marbäck: Bäckagården, skärningen vid Korpebo. S. Säm: Ramasjön [= Kullabo (Kj)]. Ölsremma: Komosse. Hillared: Hösjön (Hpn), Kärraholm, Lagsjön. Sexdrega: Abborrsjön, Hullsjön, Lockryd (id.), Lövdala (id.). *Ås.* Murum: Ömmern (TH). Hällstad:

Gisslarp (S), Hof, Igelsjön, Knapagården (TH), L. Björken (S), prästgården (TH), Älmestad (S). Grovare: Grosken. Härna: Gärdsjön. S. Ving: Angsjön, Hökerum. Varnum: Viskan vid Brogården, Kvarnagården, Käringsjön o. stn. Toarp: Gånghester.

C. contigua. — *Redväg.* N. Åsarp: N om kkn, prästgården. Kölaby: Gärdet, kkn. Humla: kkn, Väddåkra. Blidsberg: St. Börsbo. Dalum: kkn, Silarp, Vedåsa. Timmele: Frännarp, Knuve (S), kkn. Vist: kkn, Vistberget. Brunn: Kråkeboberg, Åsakullen. — Solberga: kkn. Kölingared: Kölingsholm. Knätte: kkn, kullarna 500 m S om kkn, SO om Åfärd. Liared: Gudebo (Kj). Hössna: Hyåsen. Gullered (Ndm). *Kind.* Länghem: Stenbockska gravkapellet. Månstad: kkn. S. Åsarp: Oppensten (G). *Ås.* Kärråkra: Boarp. Murum: kkn, Rya, Skålarp. Hällstad: Gammalstorp (S), Hof, Påvagården. Grovare: kkn. S. Ving: kkn, Kärr, Vätersholm. Varnum: Boarp. Rångedala: Byttorp (G), Dränggården, kkn, Marsjön. Äspered: kkn, Sundholmen.

C. vulpina. — *Redväg.* Blidsberg: sumphåla mell. Hallabo o. Holmen (G). Dalum: Svenstorp (G), Tingvallakärret (G, S), Ögården (S). *Ås.* S. Vånga: Backabo (= Jonstorp) (S).

C. chordorrhiza. — *Redväg.* N. Åsarp: Alvared (vid dansbanan), prästgårdskärret. Dalum: Vinsarpskärret (S). — Liared: Skeppsholmen, Ubbholmen. Gullered: Sjögared (Ndm), Ubbared. Strängsered: Komosse (Old). *Kind.* Länghem: Angsjön, SV om Björsjön, Djurgården, Dunsjön, Lomsjön (G, S). Gällstad: Boarp, Intorp. Grönahög: Komosse. Hillared: Svederna, Åsendal, V om Åslyckan. Sexdrega: Kortö (Hpn), Källered, Lillsjön, Långsjön, Lövdala (id.), sågen (id.). S. Åsarp: Ladugården. Nittorp: sjön N om St. Spångasjön (Kj). Ljungsarp: Lid, S om Pajet. *Ås.* Möne: Viesjön (S). Hällstad: Igelsjön, L. Björken (S), Lövåsen (S), Ömmern (S).

C. disticha. — *Redväg.* N. Åsarp: Hög (S). Kölaby: Stommen. Blidsberg: Ö. om Tokarp. Dalum: Platekvarn, Ätran nedom Rom, S om Silarp, vid Silarpskullen, sluttningen nedom Vedåsa. Timmele: Brostorp (TH), Lena. Vist: Brogården. Brunn: jvgn NV om stn. — Fivlered (Hård). Böne: prästgården. Knätte: backen N om Lunds by. Hössna: Önnarp. *Ås.* Kärråkra: Boarp. Möne: mossen S om kkn (S), Rävike. Murum: Aplaberg. Hällstad: Hof, Knapagården (TH), kkn, prästgården (TH), Påvagården (S), Skattegården. Härna: Tåbol. S. Ving: prästgården. Varnum: grustag N om stn. Rångedala: Gretlanda.

C. leporina. — Allmän.

C. brunnescens. — *Ås.* Toarp: Gånghester (L) (S & S), Nygårds mosse (G, S), Tokarpsskogen (G).

C. canescens. — Allmän.

C. canescens* × *remota. — *Ås.* Toarp: Bygd (Lamboskogen) (S).

C. loliacea. – *Redväg.* Dalum: björkhage SV om Vinsarp (Hpn). — Böne: Lönnarpshult (S) (Rdb). *Ås.* S. Ving: Säby (Hård).

C. elongata. — *Redväg.* N. Åsarp: Ekeberga kvarn. Dalum: Vinsarp (Rdb), Ätran nedom Silarp. Timmele: Brostorp, Nygården, Röstesjön, Sjöbacka. Vist: Nyboholm, Vistaholm. Brunn: Brunnsnäs, St. Ekered. Ulricehamn: Lindängen. — Kölingared: N om Ingared, Marbohem-

met, Tidan vid kkn, Åråsa. Böne: Björkås. *Kind.* Tvärred: Sjöbo. Dannike: Rölle. Länghem: Torpa. Finnekumla: Fästered. Marbäck: Näsboholm, pkt 233, 5. S. Säm: Klevaberget (G). Gällstad: Bystadsjön, Intorp. *Ås.* S. Vånga: Jonstorp, Rosendal. Hällstad: Kronogården, Kyrkoskogen SO om Igelsjön (S), L. Björken. S. Ving: Ekeslunda, Fäbroarna, Hökerum, Kärr, Mogden, Röstekärr, Sjöbredared, Tångagärde (S & S). Varnum: Kvarnagården, Nitta kvarn (G), Varnumskulle, Ågården. Äspered: Vatunga. Toarp: Gånghester (CSg).

C. echinata. — Allmän.

C. remota. — *Kind.* Dannike: Rölle (G). Finnekumla: Fästered (G) (Kj!). Marbäck: Näsboholm (H. Helmrot). *Ås.* Toarp: Gånghester (B), Tokarpsskogen vid landsvägen (G).

C. elata. — *Redväg.* N. Åsarp: Alvared, Ekeberga kvarn, Fingerkvarn, Valundasjön. Kölaby: Sverkilstorp. Dalum: Tingvallakärret. Vist: Snipesjön. — Solberga: Baggekvarn. Kölingared: Jogen, Vållern. Kölingared, Böne o. Liared: Lönnern. Böne: Björkås. Liared: Holmåkra, kkn, Oset. Gullered: Sjögared (Ndm). Strängsered: Komosse (Old). *Kind.* Tvärred: Alhammar, Högagärde. Dannike: Boanäs, bäcken från Ramsjön. Länghem: Bredsjön, Djurgården, Dunsjön (Hpn), Yttre Åsunden. Finnekumla: Sundet. Marbäck: Åsunden. S. Säm: Ramasjön. Hillared: Hösjön, Veka. Roasjö: Apelsjön, Holsjön (Hpn). Sexdrega: landsvägsbron Ö om kkn (id.), sågen (id.). Hulared: Grytteredsjön. S. Åsarp: ån vid kkn o. vid Ås. *Ås.* Vid Mogden o. Tolken. Möne: Viesjön (S). Hällstad: Björkensjöarna (TH), Igelsjön (S), Knapagården (TH). Varnum: Tåsjön, vid Viskan. Toarp: Lindås, Sjögårdssjön.

C. elata* × *fusca. — *Redväg.* Hössna: Önnarp (S). *Ås.* Rångedala: Marsjön (S).

C. caespitosa. — *Redväg.* N. Åsarp: Alvared, Valunda, Åsen. Kölaby: Stommen. Blidsberg: Björnarp, prästgården, vid Ätran på gränsen till Dalum. Dalum: Björkestorp, Silarp, stn, Ätran nedom Silarp, sluttningen nedom Vedåsa, Vinsarp, Vinsarpsmossen, Svenstorp, Vång. Timmele: Alarp, Brostorp, Lena, sluttningen V om stn, Vång. Vist: Ubbared. Brunn: Långsered, vid jvgn NO om stn. — Kölingared: Ingared. Böne: N om Backgården, Hällunda, sankmarker NV om kkn, prästgården. Knätte: Karlslund, backen N om Lunds by, S om Lönnern. Liared: Prästryd. Hössna: mell. Brunsered o. Önnarp, Hössnatorp, Ryaskogen, Valareds kraftstn, Önnarp. Gullered: byn (Ndm). *Kind.* Länghem: Djurgården (Hpn). S. Säm: vid Klevaberget. Gällstad: Lid. Sexdrega: sågen 1 ex. (Hpn). *Ås.* Kärråkra: Boarp, kkn. S. Vånga: Östrabo. Möne: Bengtsgården, Bolstorp, mossen S om kkn, Tomten, Torkilstorp, Östergården. Murum: kkn, Skålarp. Hällstad: Brunstorp, Gisslarp, Hof, Knapagården, Kronogården, kkn, Lunden, Pjukarp, prästgården, Påvagården (S), Skattegården, Väby. Härna: Stommen. S. Ving: Hökerum, Öndared. Äspered: Vatunga. — Karta (fig. 5).

C. gracilis. — T. allmän.

C. fusca. — Allmän.

C. digitata. — *Redväg.* Vist: Fotåsen, Nyboholm, Vistberget. Brunn:

Kråkeboberg, vid Röstesjön, Åsakullen. — Kölingared: Valshalla. *Kind.* Tvärred: Högagärde. Länghem: Kinnaliden, Torpa. Marbäck: SV om Åsen. S. Säm: Klevaberget. Ljushult: Dalen, backen SO om kkn. Hillared: Läggared (Hpn), Såken (id.). Sexdrega: Björsjöberg (id.). *Ås.* Toarp: vid Mellsåkern.

C. globularis. — *Redväg.* Strängsered: Komosse (Old). *Kind.* Grönahög o. Ölsremma: Komosse (Old). Grönahög: Ramnö, Visnarholmen (Hård). Ölsremma: Algrena, Ekåsen (Hpn), Klunkås, Lindrum (Hård), Mörkö, Vägabo, Åremma. Nittorp: 1 km Ö om Annedal, Fiås (Hpn), NO om L. Spångasjön. Ljungsarp: 500 m Ö om Bråtaryd (Hpn), Bäckaryd, 1 km V om Genhövan (id.!), Kättsjö (G), t. allmän omkring Lagmanshagasjön, Ängabo, Ö om Övrabo.

C. caryophyllea. — *Redväg.* N. Åsarp: Alvared. Humla: Drättekvarn. Blidsberg: Kässeberg. Dalum: kkn, N om kyrkbron, Silarp, Ögården. Timmele: Nygården, Nöre. — Kölingared: Askåsen. Böne: Marbohemmet, Åfärd. Knätte: kullarna S om kkn. *Kind.* Länghem: Torpa. Sexdrega: Tjuvakulle. *Ås.* Hällstad: 6 lok. S. Ving: Svederna. Varnum: Bossgården. Rångedala: Dränggården.

C. ericetorum. — *Redväg.* Kölaby: Borred, Tummarp. Dalum: N om kyrkbron. — Knätte: kullarna S om kkn. *Kind.* Sexdrega: Källered, Tjuvakulle. *Ås.* Hällstad: St. Björken (Kj). — Anteckningarna knapphändiga för såväl denna som föregående art.

C. montana. — Allmän.

C. pilulifera. — Allmän.

C. pallescens. — T. allmän.

C. flacca. — *Redväg.* N. Åsarp: Hagaberg, Valunda. Kölaby: Sverkilstorp. Blidsberg: Björnarp, Hallabo, Kässeberg (baktrågen). Dalum: Fasttorp, Krutbrännaregården (vid jvgn) (Bdg), S om Lunnagården, vid bäcken S om Silarp, vid Tingvallakärret, Viesjön, Vång, Ögården. Timmele: Alarp, Gryteskog (S), Lena, samhället, Vång (S). Brunn: S om Röstesjön (vid jvgn). — Böne: Hyared, Hällunda, N om Årred. Knätte: S om kkn, S om Åfärd. Hössna: Ö om Hössnatorp. *Ås.* Möne: Viesjön, Östergården (S). Hällstad: Hagalund, Hof, dalen mell. Knapagården o. Hof, Lursten (S). — Karta (fig. 4).

C. livida. — *Redväg.* Strängsered: Komosse (Old). *Kind.* Länghem: NO om Angsjön (Hpn), 500 m S om Dunsjön (id.!), Ö om Dunsjön (id.!), Dunsjöbäckens utlopp i Björsjön (G), S om Vassgården (G). Grönahög: Komosse (Old). Sexdrega: Abborrsjön (Hpn), N om Björsjöberg (id.), åsgrop nära Fiskartorpet (id.), Lillesjön, Långsjön (id.!). *Ås.* Murum: Ömmern (kärr nära avloppet) (S). Äspered: Gullestorpsjön (G).

C. panicea. — Allmän.

C. vaginata. — *Redväg.* N. Åsarp: Björkelund. Humla: Haberget. Blidsberg: N om Dalakvarn. Dalum: Vinsarp. Vist: Nyboholm, Ubbared. Brunn: vid Toppsjöbäcken. — Solberga: Baggekvarn. Fivlered: Karlskoga. Kölingared: Ingared, vid Lönnern, Sjöbacken. Böne: N om kkn. Knätte: Igelsered, kullarna 500 m S om kkn, Köpmantorp. Liared: 6 lok. Hössna: 6 lok. Gullered: Boared, Ekhult, Häggarpet, Ubbared. Strängsered: Näshult, Torhult. *Kind.* Tvärred: Högagärde. Dannike:

Hult. Länghem: 5 lok. Marbäck: 6 lok. Gällstad: Björnrydet, Bystad, Intorp. Grönahög: Högaberg. Ölsremma: Grebbaslätt: Hillared: Åsendal. Sexdrega: Björkås (Hpn), Björsjöberg (id.), Skogsgården, Slätthult. S. Åsarp: Sjörred. *Ås.* Möne: Bolstorp. Hällstad: Gisslarp, Åsen (Degelius 1925). Fänneslunda: Solberga. S. Ving: Ekeslunda, Nitta, Tångagärde. Rångedala: Finnekumla. Äspered: Vatunga. Toarp: Andared, Bygd (G), Ekås (S), Nygårds mosse (G), Sjögården, Skinnarehult.

C. magellanica. — *Redväg.* N. Åsarp: Alvared (vid dansbanan), Ekeberga kvarn, Fingerkvarn. Timmele: L. Kroksjön. Vist: Snipesjön. Brunn: Brunnsnäs, Toppsjön. — Knätte: S om kkn. Liared: Holmåker. Hössna: Torinstorpet. Strängsered: Komosse, V om St. Hästhagen. *Kind.* Tvärred: Ekåsen. Länghem, Hillared o. Sexdrega: Måleksområdet. Gällstad: Påbo. Ölsremma: Komosse. Hillared: V om Åsendal. Roasjö: Apelnässjön, Mossasjön (Hpn). Sexdrega: Ensberg, Lövdala (Hpn). Dalstorp: S om Källerås. Ljungsarp: S om Pajet. *Ås.* S. Ving: Backen, Säbyskogen. Äspered: Gullestorpsjön, Sundholmen (S) (Kj). Toarp: Gånghester (CSg) (S), N om kkn (Kj), Målsryd (Backers) (G), Nordsjö (S), Råslätt (G).

C. limosa. — *Redväg.* N. Åsarp: prästgårdskärret. Dalum: Vinsarpsmossen (G, S). Timmele: St. Kroksjön. Vist: Snipesjön. Brunn: Toppsjön. — Kölingared: Lönnern (Kj). Liared: N om kkn. Strängsered: Komosse (Old). *Kind.* Tvärred: Blackered, Dammsjön (Kj). Länghem: Angsjön, Dunsjöbäcken, Sävsjön. Finnekumla: Fästered (Kj). Grönahög: Komosse (Old). Ljushult: Skanssjön (S). Hillared: Kärraholm, Svederna, Texlesjön, V om Åsendal. Roasjö: Holsjön (Hpn), Mossasjön (id.). Sexdrega: Brattåsen (GSn), Kortö (id.), Lomsjön (Hpn), Långsjön. *Ås.* Möne: Viesjön (S). Murum: kkn (Kj). Hällstad: Gisslarp (S), Hällstadmossen, Igelsjön (S), Karlstorp, Ömmern (S). Härna: Lövdala. Toarp: Drared, Gällsjö, mossen V om kkn, Nordsjön (G).

C. Buxbaumii. — *Redväg.* Solberga: Baggekvarn (Rdb). Hössna: mell. Brunsered o. Önnarp (S). *Ås.* S. Ving: Angsjön (G, S).

C. Oederi. — Allmän.

C. lepidocarpa. — *Redväg.* N. Åsarp: Alvared vid Ätran, Hagaborg, prästgårdskärret, Valunda. Kölaby: Borred, Sverkilstorp (sjöarna). Blidsberg: Dalakvarn. Dalum: S om Lunnagården, N om Plate, Tingvallakärret, Vinsarp (dalen mot kkn), Vinsarpskärret (G). Timmele: Brostorp, Lena, Nilsagården, Yttre Vång. Vist: Nyboholm, Ubbarp. Brunn: Brunnsnäs, Långsered. — Fivlered: Yttern. Kölingared (Kj). Böne: Hällunda, Marbohemmet, Vinsarpsjön. Liared: N om kkn. Hössna: Hössnatorp, Krokstorp, kärr Ö om kkn, Valared (Hpn), Önnarp. Strängsered (Kj). *Kind.* Länghem: Angsjön, Djurgården, N om Dunsjön (GSn). S. Säm (Kj). Hillared: Åsendal (G). *Ås.* Kärråkra: maderna vid kkn (S). Möne: mossen S om kkn, Sjöarp, Östergården (S). Hällstad: Hof, Knapagården, Lunden, Skattegården, Ömmern. Härna: Gärdsjön. S. Ving: Angsjön (S), Svederna. Äspered: Vatunga. — Karta (fig. 5).

C. lepidocarpa* × *Oederi. — *Redväg.* Brunn: Långsered. *Ås.* Möne: mossen S om kkn (S).

C. flava. — Allmän i *Redväg* o. *Ås*, där den noterats från samtliga socknar. Sällsyntare i *Kind.* Länghem: Djurgården. Finnekumla: Sundet. Marbäck: skärningen vid Korpeboberg, pkt 196, 4, vid Åsunden. S. Säm: Ramasjön. Hillared: Hösjön. Roasjö: Apelnäs (Hpn). Sexdrega: göl N om Björsjöberg (id.).

C. flava × *hostiana.* — *Ås.* S. Ving: Kärr (Nabben). Toarp: Målsryd (Backers) (G), Häljared (S & S).

C. flava × *lepidocarpa.* — *Ås.* Möne: mossen S om kkn.

C. flava × *Oederi.* — *Redväg.* Hössna: Gärdet. Strängsered: Tokared (S). *Kind.* Marbäck: Baeka (S). *Ås.* Varnum: Årnässjön (CSg). Toarp: Senåsa (G).

C. hostiana. — Allmän i *Redväg* o. *Ås*, där den noterats från samtliga socknar. Sällsyntare i *Kind.* Tvärred: Rude. Finnekumla: Fästered. Marbäck (Kj). S. Säm: Vegby. Grönahög: Kvarnared, Solberga (Kj). Ölsremma: Grebbaslätt. Ljushult: Backa. Hillared: Gälared, Läggared, Påtebo, Åsendal. Roasjö: Apelnässjön (Hpn), Holsjön (id.), Roasjön. Sexdrega: Björkås (id.), Björsjön (id.), Buttorp (id.), Handbynäs (id.), Sandsjönäs. Dalstorp: Sånarp. S. Åsarp: Ladugården.

C. hostiana × *lepidocarpa.* — *Ås.* Möne: Östergården (S).

C. hostiana × *Oederi.* — *Kind.* S. Säm: Vegby (S). *Ås.* Toarp: Målsryd (G).

C. capillaris. — *Redväg.* N. Åsarp: Hagaberg (ÖN). Kölaby: Borred, Sverkilstorp (G). Dalum: S om Lunnagården (G), Vinsarp (i björkskog) (S), Vång (Hård). Timmele: Yttre Vång (S). — Böne: Björkås, Marbohemmet. Liared: kärret N om kkn (G). Hössna: Brunsered, mell. Brunsered o. Önnarp. *Ås.* Kärråkra: kkn. Möne: Bolstorp, Östergården (S). Murum: Skålarp (brinkarna mot ån). Hällstad: Hof, L. Björken (S), Munkeboda (S), prästgården (TH), Påvagården (S), Tågården (TH). S. Ving: Bogakvarn (S). Rångedala: nedom Finnekumla. — Karta (fig. 4).

C. silvatica. — *Kind.* Dannike: Rölle (S). — Se vidare Westfeldt 1943.

C. pseudocyperus. — *Redväg.* Dalum: Viesjön (G, S), Vinsarp (Rdb) (Kj). *Kind.* Finnekumla: Fästered (Kj). *Ås.* Möne: Viesjön (TH).

C. rostrata. — Allmän.

C. vesicaria. — Allmän.

C. acutiformis. — *Redväg.* Blidsberg: Kässeberg. Dalum: S om Silarp. — Solberga: Baggekvarn (S). Kölingared: Ingared (S). Liared: N om kkn. Hössna: Önnarp. *Kind.* Länghem: Torpa. Hillared: Hösjöbäcken (Hpn!). S. Åsarp: ån nedom kkn. *Ås.* S. Ving: Romsås. Äspered: Vatunga. Toarp: Germundared (G, S), mell. Kilabro o. Flage mader (G).

C. lasiocarpa. — *Redväg.* Dalum: Nöresjön. Timmele: Kroksjöarna. Vist: Snipesjön. Brunn: Röstesjön. — Kölingared: Bräng en. Böne: Lönnarp (Rdb). Knätte: Lund. Liared: Gudebo (Kj). Gullered: Ekesbo (Ndm). Strängsered: Komosse (Old). *Kind.* Dannike: vid Åsunden. Länghem: Dunsjöbäcken. Gällstad: Bystadsjön. Ljushult: Skanssjön (G). Hillared: Hösjön. Sexdrega: Långsjön, Ryasjön, Ätran

(Hpn). Hulared: Grytteredsjön. *Ås.* Möne: Viesjön (S), Ömmern (TH). Hällstad: Hällstadmossen (TH), Igelsjön (TH). Grovare: Grosken. Fänneslunda: Fänneslundasjön. S. Ving: Tolken (TH). Äspered: Gullestorpsjön. Toarp: Drared (Kj), Gällsjön, Lindås (G), Sjögårdssjön, Tjärnsjön (G).

C. hirta. — *Redväg.* Smula: 4 lok. N. Åsarp: 8 lok. Kölaby: 4 lok. Humla: 5 lok. Blidsberg: 5 lok. Dalum: 10 lok. Timmele: 7 lok. Vist: 6 lok. Brunn: Kråkebo, Kälkared, Röstesjön. Ulricehamn: Lindängen. — Böne: 5 lok. Knätte: kkn, Långsered. Hössna: 5 lok. *Kind.* Länghem: Djurgården. Finnekumla: herrgården. Marbäck: Bredgården, S om kkn, Storegården. S. Säm: Bossgården. Gällstad: Götåkra, Intorp. Sexdrega: Björkås (Hpn), Buttorp, stn (id.). *Ås.* Kärråkra: kkn. S. Vånga: Östrabo. Möne: Rävike, Tomten. Murum: 5 lok. Hällstad: 7 lok. Grovare: Avelsås, Grosken. Härna: Anksjön, Tåbol. S. Ving: 15 lok. Tärby: Finnekumlasjön, kkn. Varnum: 10 lok. Äspered: Ö om kkn, Vatunga. Toarp: sandås mell. kkn o. Häljareds flogar (G).

Acorus calamus. — *Redväg.* N. Åsarp: Skäggakvarn, Vingeskvarn. Kölaby: Rynninge, Trädet, Tåstarp. Humla: vid Ätran. Dalum: Vedåsa. Timmele: Gryteskog. Brunn: sågen vid stn. Ulricehamn (Rdb). — Fivlered: Nabben. Kölingared: Kölingsholm. Knätte: Nåtared. Hössna: Duvered. Strängsered: Flathult (Ndm). *Kind.* Sexdrega: Källered (Hpn). *Ås.* Möne: Rävike. Murum: Aplaberg, Årred. Hällstad: Brunstorp. Grovare: Kvarnagärde.

Calla palustris. — *Redväg.* Timmele: Kroksjön (TH), kyrkbron. Vist: Snipesjön. — Hössna: Fagrared. Gullered: Ekesbo (Ndm). Strängsered: Komosse (Old). *Kind.* Länghem: Angsjön, Borgasjön, Haldarp, Torpa. Finnekumla: Fästered. Marbäck: Kårdamm. Ljushult: Aplared, Kärra (G), Skanssjön (G). Hillared: Trollsjön. Sexdrega: Kortösjön (GSn). Ljungsarp: Passarp (Kj). *Ås.* Hällstad: Igelsjön (S), Ömmern (TH). Fänneslunda: Sotared. Härna: Torsås. S. Ving: Ekenäs, Långholmen, Toppsjön. Rångedala: Gretlanda. Äspered: Gullestorpsjön, Lövaskog, Sundholmen. Toarp: Brattelid (Ldg), Bråthult (G), Bygd (G), Myrås (G, S), Målsryd, Tjärnsjön (G).

Lemna trisulca. — *Redväg.* Humla: i Ätran. Dalum: Plate i Ätran. *Ås.* Hällstad: Knapagården (S), prästgården (S). Varnum: Marsjön.

L. minor. — Allmän.

Juncus effusus. — Allmän.

J. conglomeratus. — Allmän.

J. filiformis. — T. allmän.

J. articulatus. — Allmän.

J. alpinus. — T. allmän.

J. bulbosus. — Allmän.

J. squarrosus. — *Redväg.* Kölaby: Kråkeberg. Dalum (Rdb). Timmele: Lena, Redvägsborg (Rdb), Vång. Vist: Härstorp. Brunn: Brunnsnäs. Ulricehamn (S). — Kölingared: Tåhult. Böne: Gamlegården. Knätte: mosse S om Lunds by. Liared: Stegerhult (Kj). Hössna: Ekbacken. Gullered: Karlabo, Ubbared. Strängsered (Kj). *Kind.* Dannike: Ramsjön. Länghem: Tingarör (Kj). S. Säm: Sandslätt (Kj).

Grönahög: 5 lok. Hillared: Hösjön. Sexdrega: Björkås (S), Skogsgården. Ljungsarp: Bäckaryd. *Ås.* S. Vånga: Rosendal (Kj). Hällstad: mell. prästgården o. Finnatorpet (TH). S. Ving: 4 lok. Rångedala: Stavared. Äspered: N om kyrkbyn, Vatunga.

J. compressus. — *Redväg.* N. Åsarp: Dörraholmen, Frugården, Skägga, stn, Ögården. Humla: Väddåkra. Blidsberg: stn. Dalum: stn, Vedåsa, Vång. Timmele: Yttre Vång. Brunn: stn. — Solberga: Baggekvarn, kkn. Kölingared: kkn, Årås. Böne: Åfärd. Hössna: Valared (Ndm). Gullered: byn, poststn, Tissered (Ndm). *Ås.* S. Vånga: Rosendal. Möne: Rävike. Murum: Aplaberg, kkn, Skålarp. Hällstad: Dannarp, Hof, kkn, N om L. Björken, prästgården, Väby. Härna: kkn, Tissås. S. Ving: kkn, Romsås, Trogared. Varnum: Ågården. Rångedala: kkn, Vevelhult. Toarp: Målsryd.

J. macer. — *Redväg.* Ulricehamn: utfyllnaden nedom Lindängen. — Kölingared: Lönnern (på sjöstrand) (Kj). *Ås.* Toarp: Målsryd.

J. bufonius. — Allmän.

J. stygius. — *Kind.* Grönahög: Komosse (Old). Nittorp: St. Spångasjön (Kj).

Luzula pilosa. — Allmän.

L. silvatica. — *Kind.* Gällstad: Torsbo (trädgård tillsammans med *L. luzuloides*).

L. luzuloides (*nemorosa*). — *Kind.* Länghem: vid Angsjön [= Haldarpsjön?] (Kj), Haldarp (S & S). Gällstad: Torsbo. Ljushult: Aplared (banvallen). *Ås.* Fänneslunda: Solberga. Toarp: Gånghester (S), Målsryd (banvallen), Skår (S).

L. campestris. — Allmän.

L. multiflora. — Allmän.

L. multiflora ssp. ***congesta.*** — *Ås.* Toarp: Häglared (G, S).

Narthecium ossifragum. — *Redväg.* Hössna: L. Fagrared, S om Torinstorpet. Strängsered: Kimmarebo (Ndm), Komosse. *Kind.* Länghem: SO om Forsa (G), Ö om kkn, Sävsjön. Grönahög: Komosse (Old), Solberga (Kj). Ölsremma: Komosse (Old). Hillared: mosse SV om Åsendal. Sexdrega: Abborrsjön (Hpn), Björsjöberget, S om Blaxgärde (Tld), Borgarås (Hpn), Dalen (Tld), Lillesjön, Lomåsen, berget S om Nytorp (Tld), Smedsåsen (Hpn). Nittorp: Kroken, Moghult, Stockremma. *Ås.* Rångedala: Gretlanda.

Allium oleraceum. — *Redväg.* Blidsberg: Dalakvarn, Kässeberg (baktrågen), samhället. Dalum: Krutbrännaregården (brinkarna), Plate, Silarp, Svenstorp (moränkulle vid Ätran). Timmele: Knuve. — Knätte: S om kkn. Hössna: Valared. *Ås.* S. Ving: Aspanäs (1938), kkn. Varnum: Bossgården, Kvarnagården, Ågården. Toarp: St. Bygd (G).

Lilium bulbiferum. — *Redväg.* Kölaby: Ängaberg (i röse). Dalum: Plate (i åker). Timmele: Knuve. Brunn: Långsered (i åker), Remma. — Böne: åker N om kkn. Gullered: Ubbared (dikeskant). *Kind.* Tvärred: Rude (i åker), S. Backa. Länghem: Torpa. S. Säm: Vegby. Sexdrega: Hjärtared, Högtorpet (i åker) (Tld). *Ås.* Möne: Rävike. Hällstad: Brunstorp (i åker) (S), Lursten (i åker). Härna: Hult (i åker). S. Ving: Bredaslätt (i åker), Högryd, Mastunga (i åker). — Blommar som regel i åkrarna.

Fritillaria meleagris. — *Redväg.* Blidsberg: fv. vid prästgården (ÖN!).

Gagea lutea. — *Redväg.* Humla: moränåsar vid Ätran. Blidsberg: Dalakvarn, Kässeberg. Dalum: Gustavsberg, Plate, Vinsarp, Vång. Timmele: Brostorp, kkn, Nöre. Brunn: 10 lok. Ulricehamn: Lindängen. — Kölingared: 6 lok. Böne: kkn, Lönnarp. Liared: Tuskan. Hössna: 6 lok. Gullered (Ndm). *Kind.* Tvärred: 5 lok. Dannike: Boanäs, Rölle, Stuvhult. Länghem: Hovsnäs, Torpa. Finnekumla: 7 lok. Marbäck: 7 lok. S. Säm: 5 lok. Gällstad: SO om Hjortsbacka, Intorp, kkn, Torsbo. Grönahög: Åbjörntorp. Ljushult: Backa, Hule, Håhult, Stommen. Sexdrega: Björkås (GSn), Götshult, Handbynäs, Sandsjönäs, Skogsgården. Hulared: Stålared. S. Åsarp: Ladugården. *Ås.* S. Vånga: Rosendal, Vånga by. Hällstad: Hof, prästgården m. fl. lok. (TH). Grovare: Bergsgärde. Fänneslunda: herrgården, Solberga. Härna: Tissås. S. Ving: 10 lok. Varnum: Dållebo. Rångedala: 6 lok. Äspered: 11 lok. Toarp: 14 lok.

G. minima. — *Redväg.* Ulricehamn: gla kyrkogården. — Liared: Gudebo. *Kind.* Länghem: Hovsnäs, V om Lillsjön, Torpa. Finnekumla: F:a herrgård, Fästered. S. Säm: Attorp, Lindholmen (G). Gällstad: Intorp, kkn. Sexdrega: Buttorp. *Ås.* S. Ving: Hökerum (G), Säby. Toarp: Bygd (fv.), Drared. — Karta (fig. 7).

Muscari botryoides. — *Redväg.* Dalum: Vinsarp. *Ås.* S. Ving: Tomta (fv.). Rångedala: Finnekumla. Toarp: Skenstad.

Ornithogalum umbellatum. — *Redväg.* Dalum: ödetorp S om Vinsarp. — Knätte: kkn. *Kind.* Sexdrega: ödegård vid Aspelund (GSn).

Maianthemum bifolium. — Allmän.

Polygonatum odoratum. — *Redväg.* Smula: L. Fagerås, vid bron över Skråern. N. Åsarp: Alvared, Åsarp Rättaregården. Kölaby: Borred, Danstorp, N om Åsen. Blidsberg: Kässeberg (baktrågen). Dalum: Krutbrännaregården, Plate, Silarpskullen, Svenstorp, Vång, Ögården. Timmele: Frännarp, Knuve, Nöre. Vist: Ubbarp. Brunn: Brämmesås, Kråkeboberg, Kälkared, Åsakullen. Ulricehamn (Rdb). — Solberga: S om kkn. Kölingared: Torpa. Knätte: kullarna S om kkn. Liared: Brännered, kkn. Hössna: åsen vid kkn. Gullered (Ndm). Strängsered (id.). *Kind.* Tvärred: Tvärredslund. Länghem: Djurgården. Finnekumla: Sundet. Marbäck: moränkullar S om Storegården. S. Säm: Klevaberget. Grönahög: Solstugebacken, Östentorp. Ljushult: Stommen. Hillared: banvallen vid Åsendal. Sexdrega: NV om Angsjön, Björkås (Tld), Buttorp (id.), åsen vid Hagalundsjön, Kortö (GSn), Ringestena (id.), Segerstad (Tld). Dalstorp: Boarp. Hulared: Stålared. S. Åsarp: Oppensten. *Ås.* Kärråkra: kyrkbyn. Murum (Kj). Hällstad: Brunstorp, Skattegården (TH), Älmestad. Grovare: Avelsås. Fänneslunda: Karstorp. Härna: Anksjön, Björnsgården. S. Ving: Nollyckan, Tångagärde, Töve. Varnum: Björkudden. Rångedala (S). Äspered: Vatunga. Toarp: Skenstad, Taryd (Ldg).

P. multiflorum. — *Redväg.* N. Åsarp: Väberga kvarn. Brunn: Kråkeboberg. Ulricehamn 1782. *Kind.* Tvärred: Alhammar. Länghem: Torpa (vid gården o. på näset). Marbäck: Korpeboberg, Kärrabo.

Sexdrega: Kortö (GSn). *Ås.* Härna: Nitta. Varnum: Kvarnagården. Rångedala: Gravryd.

P. multiflorum* × *odoratum. — *Ås.* Toarp: Bygd (1884 O. E. Olson) (G).

P. verticillatum. — *Redväg.* Humla: ekbacke NV om kkn. Blidsberg: Dalakvarn, Holmen, Kässeberg, St. Börsbo. Dalum: bäcken S om Krutbrännaregården, Plate, Silarp, Svenstorp, Vång. Timmele: Gärdet, Knuve, Lena. Vist: Härstorp, Svensholm, Ubbarp. Brunn: Brämmesås, Gäla, Kråkeboberg, Kälkared, Remma, Snipe, Åsakullen. Ulricehamn: Brunnsbo (S), Stadslyckorna (G). — Kölingared: Baggekulla, Ingared, Kölingsholm (Kj), S om Årås. Böne (Rdb). Knätte: Köpmantorp, Långsered. Liared: Oset, Tuskan (Ndm). Hössna: Halla, Hjortåsen, Krokstorp, Önnarp. Gullered: Hultagärde. *Kind.* Tvärred: Alhammar, Brosered, Högagärde. Dannike: Backa, Rölle. Länghem: Kinnaliden, Sällerås (Hpn). Finnekumla: Fästered. Marbäck: Bäckagården (Kj), Kärrabo, Sjö-Gunnarsbo, Stensered. S. Säm: Klevaberget, Vegby. Grönahög: Solstugebacken, Åbjörntorp, Östentorp. Sexdrega: Björkås (Tld). S. Åsarp: Limmared (S), Skårtebo (Hård). *Ås.* Hällstad: kkn. Fänneslunda: Karstorp. S. Ving: Björnkällan, Bogakvarn, Hökerum (S), Romsås, Senered, Sjögården, Tångagärde, Töve. Varnum: Boarp. Rångedala: Finnekumla (G), Gravryd, Klockaregården, Kristinelund (S), Lindås (G), Nolgården (G). Äspered: Lövaskog, Sundholmen, Vatunga. Toarp: Bygd (S), Drared, Germundared (G, U), Germundstorp (G, L, S), Sjögården, Slätthult (S, U).

Convallaria majalis. — Allmän.

Paris quadrifolia. — T. allmän. Dock ej sedd i Smula o. Fivlered i *Redväg*, Ljushult, Hillared o. Dalstorp i *Kind* samt i de nordligaste socknarna i *Ås* (utom Hällstad).

Iris pseudacorus. — *Redväg.* Spridd längs Ätran från Smula till Åsunden. Dessutom i Vinsarpsjön i Dalum o. Böne samt i Ätran i sistnämnda socken. *Kind.* Dannike: Forsa. Hillared: stn (Kj). Sexdrega: Billeberg, Buttorp, Kortö (GSn). Månstad: Månstadkulle. *Ås.* Varnum: Kyrksjön, Viskan vid Ågården. Rångedala: Klämmeström, Mellsjön.

[*Cypripedium calceolus.* — *Redväg.* Ulricehamn: St. Skottek (Kj). — En skolpojksuppgift, som ej styrkts, varför den bör utgå. Jfr sid. 652.]

Orchis mascula. — *Redväg.* Brunn: Kälkared (S), St. Ekered. *Ås.* S. Ving: mell. Hästskoslätt o. Trogared (G). — Se närmare Westfeldt 1943.

O. incarnata. — *Redväg.* N. Åsarp: Alvared, prästgårdskärret, Valunda. Kölaby: 2 km V om Trädet (Bdg). Dalum: Viesjön, Vinsarp, Vinsarpskärret, Vång. Timmele: Bredsjön, Gryteskog (TH), Lena, Yttre Vång. Ulricehamn 1782. — Böne: Gamlegården, mell. kkn o. Åfärd, S om Vinsarpsjön, S om Åfärd. Knätte: Igelsered, N om kkn. Liared: Gudebo (Kj), Ryaskogen. Hössna: Brunsered, Hössnatorp, kärret Ö om kkn, Ö om Valared, Valareds kraftstn, mell. Önnarp o. Oset. Gullered: Karlskog (Ndm), 1 km V om Ubbared. *Kind.* Marbäck: Källebacka (Hård), Sjö-Gunnarsbo (B). Grönahög: Komosse (Old). Hillared: tvenne mossar V o. SV om Åsendal. Sexdrega: Ringestena (GSn), Sandsjönäs

vid Lysjön (G). *Ås.* Möne: Viesjön (S), Yttergården (S), Östergården (S). Hällstad: N om Hof, Hällstadmossen (S), Lursten. S. Ving: mell. Backen o. kkn (G). Rångedala: Marsjön. Toarp: Bygd (G). — Karta (fig. 7).

(Verklig albino förekommer vid *Redväg.* Gullered: 1 km V om Ubbared 2 ex. 1953 (U) o. *Ås.* Hällstad: Lursten 1 ex. 1952 (U). Jfr NANNFELDT 1944 o. 1952.)

O. Traunsteineri. — *Redväg.* Dalum: Vinsarpskärret (G). — Gullered: 1 km V om Ubbared (U). *Kind.* Länghem: Djurgården (Hpn!), Måleksområdet (G, U) (det. J. A. Nannfeldt). Sexdrega: Lomåsen (Martin Svensson!). — Karta (fig. 7).

O. maculata. — *Redväg.* N. Åsarp: Ekeberga kvarn, Valunda, Väberga kvarn. Kölaby: Kungsgården. Humla: N om kkn. Dalum: Silarp, Vinsarp. Timmele: Lena, Sjöbacka, stn. Brunn: Kråkeboberg, Kälkared, Långsered, Snipe. — Solberga: Bogakvarn. Fivlered: St. Loppås. Kölingared: Baggekulla, Stensered, Valshalla. Liared: Gudebo, Ubbholmen. Hössna: Valared. Gullered: 7 lok. Strängsered: Komosse (OLD), Näshult, St. Hästhagen. *Kind.* Tvärred: Hule. Dannike: Ö om Bodarna, Hult. Länghem: prästgården, stn. Marbäck: Bredgården. Grönahög: Kvarnared. Ölsremma: Grebbaslätt. Hillared: samhället. Sexdrega: 8 lok. *Ås.* Hällstad: Boängen (TH), Granared (TH), Tågården (TH), NV om prästgården (TH). Grovare: Avelsås. Fänneslunda: Solberga. S. Ving: 8 lok. Äspered: Hägnagärde. Toarp: Långhult (Bdg), Målsryd (Ldg).

Leucorchis albida. — *Redväg.* Vist (RDB). Ulricehamn (S). — Solberga (RDB). Liared: Tuskan (Ndm). Gullered (id.). *Kind.* Sexdrega: Björkäng (Tld), Högstorp (id.). *Ås.* Möne: Östergården. Härna: runstenen N om kkn. S. Ving: Ekeslunda. Toarp: Råslätt (G).

Gymnadenia conopsea. — *Redväg.* Dalum: Vinsarp. Timmele: Brostorp, Lena. Ulricehamn (S). — Knätte: mosse SO om Lunds by. Hössna: Brunsered, mell. Brunsered o. Önnarp, Krokstorp (Ndm). *Kind.* Sexdrega: Lysjön vid Sandsjönäs (G). *Ås.* Grovare: Myrekulla (CSg). Toarp: Bygd (G).

Platanthera bifolia. — *Redväg.* N. Åsarp: prästgårdskärret. Blidsberg: St. Börsbo. Timmele: Brostorp, Lena, Redvägsborg. Brunn: Kråkeboberg. — Fivlered: Källeryd, St. Loppås. Kölingared: Marbohemmet, Valshalla. Liared: S om kkn. Hössna: Krokstorp (Ndm). *Kind.* Dannike: Rölle (G). S. Säm: Sandslätt (KJ), Vegby. Ljushult: Dalen. Hillared: Hultet. Sexdrega: Björsjön (Hpn), Målek (Tld), Sandsjönäs (id.). *Ås.* S. Vånga: Jonstorp. Hällstad: Katthög. Grovare: Avelsås, Bränning. S. Ving: Angsjön, Björnkällan, Bryggaregården, kkn (KJ), Säby. Varnum: kkn. Rångedala: Marsjön. Äspered: Hägnagärde.

P. chlorantha. — *Redväg.* N. Åsarp: Björkelund, V om Hansagården, Valunda. Kölaby: Kungsgården, Lundby. Humla: Väddåkra. Blidsberg: Dalakvarn, SV om Påarp. Dalum: 6 lok. Timmele: 8 lok. Vist: 3 lok. Brunn: 5 lok. — Fivlered: St. Loppås. Kölingared: 7 lok. Böne: 6 lok. Knätte: 9 lok. Liared: Gudebo. Hössna: 10 lok. Gullered: Backen, Ekesbo, SV om Nolsjön. *Kind.* Tvärred: 5 lok. Dannike:

Lugnet, Slätten. Länghem: 5 lok. Finnekumla: 3 lok. Marbäck: 6 lok. S. Säm: 3 lok. Ljushult: Stommen. Sexdrega: 6 lok. *Ås.* Kärråkra: kkn. S. Vånga: mell. Murum o. Vånga. Möne: Östergården. Hällstad: 11 lok. Fänneslunda: Solberga. Härna: Tissås. S. Ving: 11 lok. Tärby: Bäckäng. Rångedala: 4 lok. Äspered: 3 lok. Toarp: Långhult, Sjögården, Tokarpsängen.

Herminium monorchis. — *Redväg.* Ulricehamn (Rdb).

Listera ovata. — *Redväg.* Dalum: Plate. Vist: Hester. Brunn: Kråkeboberg (ÖN!). Ulricehamn: ovan samskolan 1920 (Nils Bern). — Kölingared: Askåsen. Hössna: Önnarp. *Kind.* Dannike: Rölle. Marbäck: skärningen vid Korpebo (H. Helmrot). Grönahög: Ingeshult, Åbjörntorp (Kvl). *Ås.* Grovare: Myrekulla (CSg). S. Ving: mell. Björnkällan o. Romsås. Rångedala: Gravryd, Marsjön. Toarp: Senåsa (G).

L. cordata. — *Redväg.* N. Åsarp: Holmestorp (U). Humla: Väddåkra (ÖN). Brunn: Röstesjön. Ulricehamn: Lönneberg (U). — Hössna: Hössnatorp. Gullered: Ekesbo (Ndm). *Kind.* Marbäck: Korpebo (ÖN). Grönahög: Ingeshult. Ljushult: Nytorp (Einar Ränge). Sexdrega: Billebergsåsen (Hpn). *Ås.* Hällstad: Lövåsen (Rökebo) (S), prästgårdsskogen. S. Ving: Säby, Öndared. Äspered: NV om Hallabron. Toarp: Bygds skog (G).

Neottia nidus-avis. — *Redväg.* Vist: Vistberget (ÖN). Brunn: Kråkeboberg. Ulricehamn (Rdb). *Kind.* Dannike: Rölle (S). — Se närmare Westfeldt 1943.

Epipactis palustris. — *Redväg.* Kölaby: Sverkilstorp (övre sjön). Humla (S). Dalum: bäckdal N om Plate, Vinsarpsmossen. Timmele: torpet Skogslund i Yttre Vång. — Böne: prästgården. Hössna: N om prästgården, Önnarp. *Ås.* Möne: mosskanten nedom Östergården (S), Rävike. Hällstad: Hof, dalen mell. Hof o. Kronogården (CSg), Lunden (S). Härna: SV om byn (Bdg). S. Ving: Tissås (ÖN!). — Karta (fig. 4).

E. helleborine. — *Redväg.* Dalum: björkskog SV om Vinsarp (S).

Goodyera repens. — *Redväg.* Humla: Väddåkra (ÖN). Timmele: Alarp, mell. Bjättlunda o. Vedermödan, Nättlyckan. — Solberga: N om Ingabo (vid vägen). Gullered: Ekesbo (Ndm), Sjögared (id.). *Kind.* Marbäck: Korpebo (ÖN). Sexdrega: Buttorp (Tld), Kattorp (id.), Ringestena (GSn). Dalstorp: prästgårdsskogen (Kvl). *Ås.* S. Ving: Aspanäs, Säby. Varnum: Nitta, Ågården. Toarp: Germundared (S, U), Skår (Ldg), Tokarpsskogen (G).

Hammarbya paludosa. — *Kind.* Grönahög: Komosse (Old).

Corallorhiza trifida. — *Redväg.* Humla: Väddåkra. Dalum: Vinsarp (Rdb). Vist: Härstorp, Snipesjön (ÖN). Brunn: vid Åsunden. Ulricehamn (Rdb). — Kölingared: Kölingsholm, Valshalla. Hössna: Öv. Rullen. Gullered: Ekesbo. Strängsered: Djupedal (Ndm). *Kind.* Länghem: Djurgårdskärret (Hpn), 1 km SO om Forsa. Gällstad: Bystadsjön. Grönahög: Ingeshult. Ljushult: kkn (E. Ränge). Sexdrega: Buttorp (Tld), Kattorp (id.), Ryasjö (Hpn). *Ås.* Hällstad: Knapagården, N om kkn. Murum: V om kkn. S. Ving: Angsjön, Mogden, Vedermödan, Öndared. Varnum: Marsjön. Rångedala: Marsjön, Mellsjön.

Äspered: Hallabron, Vatunga (S). Toarp: Germundared (G), Målsryd (Ldg), Skår (S), Tränghult (Ldg).

Populus tremula. — Allmän.

Salix nigricans. — Spridd över hela området, sällsyntare söderut.

S. cinerea. — Utbredning som föregående.

S. aurita. — Allmän.

S. caprea. — Allmän.

S. depressa ssp. ***livida***. — *Redväg.* Smula: Kolbrandstorp, L. Fagerås, bron över Skråern, åsarna. N. Åsarp: Hansagården, moränkulle 500 m S om jvgsbron, pkt 222, 4, Åsen. Kölaby: moränåsen S om Åsen. Humla: N om kkn. Blidsberg: Björnarp. Dalum: Silarpskullen, Svenstorp (såväl S om gården som på moränkulle vid Ätran), Vinsarp. Timmele: Sjöbacka. Vist: Ubbarp. — Solberga: åsen S om kkn. Fivlered: Yttern. Kölingared: Valshalla. Böne: Vinsarpsjön. Knätte: moränkullarna 500 m S om kkn (S). Liared: åsen S om kkn, Ryaskogen. Hössna: Holmarp, Hössnatorp, Kinnared, N om prästgården, Ryaskogen, skjutbanan, Valared, Önnarp. *Kind.* Sexdrega: rullstensåsen vid Hagalundsjön. *Ås.* Kärråkra: Öjelunda. Möne (Rdb). Hällstad: Dannarp, Snugge, Väby (S), Åsen, S om Älmestad. Härna: sluttningen mot Gärdsjön. S. Ving: Backen, Långholmen. Varnum: Kvarnagården. Rångedala: Finnekumla (S), nära kvarnen vid Klämmestorp (L). — Karta (fig. 6).

S. repens. — Allmän.

S. hastata. — *Redväg.* Smula: bron över Skråern, vid Smula åsar. N. Åsarp: Alvared, Dörragården, Fingerkvarn, Hansagården, S om Hög, kärr vid jvgsbron, prästgårdstjärnen, Valunda, Åsarp. Kölaby: Borred, Danstorp, kärr vid pkt 221, 9, Stommen, Sverkilstorp, Trädets gård. Humla (Rdb). Dalum: Krutbrännaregården, Svenstorp, Viesjön, Vinsarpsjön. Timmele: Bredsjön. Brunn: Brunnsnäs vid Åsunden. — Solberga: 1,5 km N om kkn. Fivlered: kkn (Kj), åkant nära Lönnern (S). Kölingared: Lönnern nedom Kölingsholm, Vållered (1 ex.). Böne: Marbohemmet, Storegården. Knätte: S om kkn, Lönnarp, vid Lönnern. Hössna: Hössnatorp, L. Fagrared, prästgården, Önnarp. *Kind.* Tvärred: Arnungared. S. Säm: Ramasjön. Hillared: Åsendal. *Ås.* Kärråkra: kkn. Möne: Bolstorp, mossen S om kkn, mell. kkn o. Rävike. Hällstad: Djupedal (S), Hof, Igelsjön, Lunden, Åsen (Degelius 1925). Fänneslunda: Ö om sjön. Härna: sluttningen mot Gärdsjön. S. Ving: Mogden (norra stranden). Tärby: Yttre Marsjön. Varnum: grustag N om stn, ån mell. sjöarna. Rångedala: nedom Finnekumla, nära Marsjön (S), längs vägen mell. Rångedala o. Varnum. Toarp: Häljared, Kronäng (S & S!), Tubbarps grind (A. O. Olson). — Karta (fig. 6).

S. viminalis. — *Redväg.* Smula: Breskekvarn. Vist: Prången. Ulricehamn: Åsunden. *Ås.* Murum: Sölvarp, Årred. Hällstad: Hof, kkn. Rångedala: Marsjön, stn. Äspered: Lövaskog.

S. purpurea. — *Redväg.* Kölingared: Lönnern nedom Kölingsholm.

S. daphnoides ssp. ***acutifolia***. — *Ås.* Varnum: Ågården vid Kyrksjön. Rångedala: ån mell. Marsjön o. Mellsjön, Yttre Marsjön nedom Finnekumla. — Överallt utgången.

S. alba. — *Redväg.* Humla: vid Ätran. *Ås.* Hällstad: Brunstorp. S. Ving: Hökerum.

S. fragilis. — *Redväg.* N. Åsarp: Skäggakvarn, Vingeskvarn. Timmele: kyrkbron. Brunn o. Ulricehamn: vid Åsunden. *Kind.* Dannike: Forsa, Stålåsen. S. Säm: Vegby. Dalstorp: Gundlabo. *Ås.* S. Ving: enst. ex. flerst. mell. Tolken o. Mogden. Varnum: Kvarnagården. Rångedala: Klämmeström, Ormåsa (vid ån).

S. triandra. — *Redväg.* Ulricehamn: Åsunden.

S. pentandra. — Allmän.

Myrica gale. — Allmän.

Corylus avellana. — Allmän.

Betula verrucosa. — Allmän.

B. pubescens. — Allmän.

B. nana. — *Kind.* Länghem: Ö om kkn (Kj), Källeberg, Rings mosse (L), S om sjön Vassgården (Hpn!). Hillared: Svederna. *Ås.* Tärby: Klevarna (Nordvall 1867 — ej återfunnen).

B. nana × ***pubescens.*** — *Kind.* Länghem: Rings mosse (Nils Ahlström), S om sjön Vassgården.

Alnus glutinosa. — Allmän.

A. glutinosa × ***incana.*** — *Redväg.* Brunn: St. Ekered (S). *Ås.* Hällstad: Djupedal, St. Björken, Åsen (Degelius 1925). S. Ving: Bogakvarn, Mogden (S), Romsås. Varnum: Marsjön (S & S). Rångedala: strax S om stn. Toarp: Germundared (S), Slätthult (S).

A. incana. — *Redväg.* N. Åsarp: Björkelund. Kölaby: Sandvadskvarn, stn. — Solberga: 1,5 km N om kkn. — Allmän längs Ätran från Humla: Drättekvarn till Åsunden. I Hössnadalen från Dalum: Vinsarpsjön till Hössna: Valared o. Gullered: Hjälmsered samt i bäckdalarna på omgivande höjdsträckningar. Sällsynt längs Tidan i Kölingared, Liared o. Gullered. Strängsered: Tokared, Ögärdet. Saknas inom häradets nordligaste socknar, Smula o. Fivlered. *Kind.* Tvärred o. Marbäck på enstaka punkter vid Åsunden. Finnekumla: Åsunden N om Sundet. Marbäck: allmän i bäckdalarna Ö om kkn. S. Säm: Bossgården samt Sämsjön vid Vegby. Gällstad: Frölunda. Grönahög: Ingeshult, Kvarnared, kkn. Ölsremma: Åremma. Ljushult: dalen V om kkn. Dalstorp: Jälmafors. Ljungsarp: bäcken Ö om kkn. — Saknas helt kring Yttre Åsunden o. längs Ätran till Svenljunga. *Ås.* Allmän i de större dalgångarna varjämte den förekommer spridd på omgivande höjdsträckningar. Ej sedd i Fänneslunda.

Fagus silvatica. — *Redväg.* Brunn: Kråkeboberg, Åsakullen samt längs Åsunden söderut mot Tvärred. Ulricehamn 1782. *Kind.* Tvärred: kring Dammsjön, SO om Tolken, längs Åsunden. Dannike: V om kkn, Rölle, Stenshult (jfr sid. 655), Stuvhult. Marbäck: enstaka ex. vid Åsunden. Grönahög: Bosebo, Högaberg, Intaget, Odela, Torsberg. Ljushult: mell. Aplared o. Roppered. Hillared: Hinnared, kring Såken. *Ås.* Murum: Munkaberg. Grovare: N om Grosken. Fänneslunda: Sotared. S. Ving: Bredaslätt (vild?). Äspered: Askanäs, Dalshester, Hallabron, Sundholmen, Vatunga, Åsen. Toarp: Bråthult (S), Drared, Germundared, S om Hjortryd, Kanåsen, Kulla (S), Lindås, Mellsåkern, Målsryd (S), Ny-

gård (S), Ryd, Råslätt (S), Sjögårdssjön, Skinnarehult (S), Skår, Skäftingsbacka, Stålarp, Trollmadra (S).

Quercus robur. — Allmän.

Q. petraea. — *Redväg.* Vist: Fotåsen. Brunn: Kråkeboberg, Åsakullen. Ulricehamn (Rdb). *Kind.* Länghem: Givarp. Ljushult: Hallared (G), Kanikabol (G), Roppered. Sexdrega: Björsjöberg, Handbynäs (Hård). *Ås.* Hällstad: Påvagården. Grovare: Avelsås (G), Bergsgärde. S. Ving: Ekeslunda. Rångedala: mell. Falskog o. Gretlanda. Toarp: Bygd (S&S), Germundared (G), Målsryd (G), Nygårds hage (G), Skår (G).

Q. petraea* × *robur. — *Redväg.* Timmele: Kattåkra (det. C. Blom). *Kind.* Länghem: Kinnaliden (det. C. Blom). Ljushult: mell. Aplared o. Hallared (G), Hallared (G, S), Kanikabol (G, S). *Ås.* S. Ving: Ekeslunda. Toarp: Bygd (L, S), Germundared (G, S), Kulla (G, S), Målsryd (G, L, S), Nygård (S), Skårsdal (G, S), Slätthult (G, S), Tubbared (G, S), Skinnarehult (G). Jfr Weimarck 1947.

Ulmus glabra ssp. ***scabra.*** — *Redväg.* Blidsberg: Kässeberg (baktrågen), ån vid samhället. Timmele: Bjättlunda, Ekarp, Gryteskog, Knuve. Vist: bergsstupen. Brunn: Brämmesås, Kråkeboberg, Kälkared, Remma. Ulricehamn: Lindängen. — Kölingared: Baggekulla, Valshalla, Årås. Hössna: Björkelund, Duvered, Halla, Hjortåsen, Kinnared, Öndared. Strängsered: Kimmarebo. *Kind.* Tvärred: Alhammar, Hand, Hjärtsbo, Kärrabo, Rude, Skog, Tvärredslund. Dannike: Rölle. Länghem: Kinnaliden. Finnekumla: Lindevik, Sjörred, Sundet, Övrarp. Marbäck: Korpebo, Källebacka, Kärrabo, stn. S. Säm: Klevaberget. Grönahög: Östentorp. Ljushult: Roppered. Roasjö: kkn. Sexdrega: Handbynäs. Hulared: Stålared. *Ås.* Hällstad: Hof. S. Ving: Björnared, Bredaslätt, Trogared, Tångagärde. Varnum: Boarp. Rångedala: Gravryd. Äspered: Hägnagärde, Sundholmen, Vatunga. Toarp: Drared, Målsryd (S), Sjögården, Skår, Slätthult (S), Tränghult (S), Åsen.

Humulus lupulus. — *Redväg.* Blidsberg: Dalakvarn. Dalum: Plate (vid jvgn). Timmele: Bjättlunda, Kroken, bron vid kkn, sluttningen ovan Källeberg. Vist: Ubbarp, Vistberget. Brunn: Långsered. *Kind.* Marbäck: bäcken vid Storegården, tunneln. S. Säm: Attorp, Klevaberget, Vegby (vid bäcken). *Ås.* Hällstad: Brunstorp (TH), Pjukarp (TH). Fänneslunda: Solberga. Varnum: Boarp, Bossgården. Rångedala: vid bäcken från Algutstorp, Gravryd. Äspered: Vatunga.

Urtica urens. — T. allmän.

U. dioeca. — Allmän.

Rumex hydrolapathum. — *Redväg.* Dalum: Platekvarn. Timmele: Klockaregården, kyrkbron, Ätran S om Plate. Vist: Brogården (Slottet), bron vid kkn. Brunn: Åsunden. Ulricehamn: Ätran vid Oset.

R. domesticus. — T. allmän.

R. domesticus* × *obtusifolius. — *Ås.* Toarp: Målsryd (Ldg).

R. crispus. — T. allmän.

R. crispus* × *domesticus. — *Ås.* Toarp: Målsryd (Ldg).

R. crispus* × *obtusifolius. — *Ås.* Toarp: Målsryd (Ldg).

R. obtusifolius. — *Redväg.* Brunn: St. Ekered. — Kölingared: Årås. *Kind.* Finnekumla: Sundet. Marbäck: bäcken vid kkn. Gäll-

stad: Intorp. *Ås.* Kärråkra: kkn (TH). S. Vånga: Rosendal. Äspered: Hägnagärde. Toarp: Drared, Häljared, L. Bygd (B), Målsryd (Ldg), Sjögården, Skäftingsbacka, Slätthult.

R. acetosa. — Allmän.

R. acetosella. — Allmän.

Polygonum aviculare. — Allmän.

P. viviparum. — Allmän i Ätradalen N om Åsunden samt i *Ås* härad. Betydligt sällsyntare i östra Redväg o. Kind. *Redväg.* Solberga: Baggekvarn, Väberga kvarn. Kölingared: 7 lok. Böne: 4 lok. Knätte: 5 lok. Liared: 10 lok. Hössna: 9 lok. Gullered: 7 lok. Strångsered: 4 lok. *Kind.* Tvärred: Alhammar, S. Backa. Marbäck: Hyared, Näsboholm. S. Säm: Ramasjön. Grönahög: Ingeshult, Östentorp. Ölsremma: Komosse (Old), kkn. Hillared: Spångasjön. Sexdrega: Sandsjönäs, Skogsgården. Dalstorp: Boarp, Sånarp.

P. bistorta. — *Ås.* Toarp: Målsryds stn (fv.), St. Bygd (S) (fv.).

P. amphibium. — T. allmän.

P. persicaria. — T. allmän.

P. lapathifolium. — Allmän.

P. hydropiper. — Allmän.

P. sachalinense. — *Ås.* Rångedala: Gretlanda (vägkant).

P. dumetorum. — *Redväg.* Vist: Vistberget. Brunn: Kråkeboberg. *Ås.* Varnum: Boarp.

P. convolvulus. — Allmän.

P. fagopyrum. — *Ås.* Hällstad: Skattegården 1925. S. Ving: Hökerum 1925. Rångedala: Falskog (S & S). Äspered: Sundholmen 1939.

P. tataricum. — *Redväg.* Kölaby: Trädet 1947.

Chenopodium album. — Allmän.

Ch. suecicum. — *Kind.* Ljushult (S). *Ås.* Toarp: Bygd (S).

Ch. pratericola (*leptophyllum*). — *Ås.* Fänneslunda: herrgården. S. Ving: Hökerums stn 1925.

Ch. polyspermum. — *Redväg.* Vist: nya sopstn 1954. Ulricehamn 1782.

Ch. murale. — *Redväg.* Ulricehamn: stn 1932.

Ch. bonus-Henricus. — *Redväg.* Smula: kkn, Stommen. Blidsberg (Ndm). Dalum: Svenstorp. Timmele: folkskolan (G), Knuve, kkn. Brunn: St. Ekered. — Knätte: Köpmantorp (Ndm). *Ås.* S. Ving: kkn, Tomta.

Ch. schraderianum. — *Redväg.* Ulricehamn: Åsundens trikåfabrik 1948 (G) (det. C. Blom).

Ch. glaucum. — *Redväg.* Ulricehamn 1782. *Ås.* Härna: prästgården, Skräddaregården 1929. S. Ving: Aspanäs, prästgården.

Ch. rubrum. — *Redväg.* Vist: kyrkogården, nya sopstn 1952. Brunn: Brunnsnäs. Ulricehamn 1782. *Ås.* S. Ving: Hökerum, Nygården, Sjöbredared 1941.

Ch. foliosum. — *Redväg.* Böne: Björkhult (Hård).

Atriplex hortensis. — *Redväg.* Vist: nya sopstn 1952.

A. patula. — Allmän.

Salsola tragus. — *Ås.* S. Ving: Hökerums stn 1925. (Westfeldt 1926 s. n. *S. kali.*)

Montia lamprosperma. — *Redväg.* Dalum: Vång. Timmele: Lena. Vist: skjutbanan (ÖN). Brunn: Kråkebo. Ulricehamn: Lindängen. — Kölingared: Sandbäcken (Kj). Böne: Hällunda, Åfärd. Knätte: Lund (Ndm). Gullered: Ekesbo (id.). *Kind.* Tvärred: Alhammar, Fagerberg. Dannike: Rölle. Finnekumla: Fästered. Ölsremma: Åremma. Hillared: Mölnered. Sexdrega: Kortö (GSn). *Ås.* Möne: mossen S om kkn. Murum: Årred. Hällstad: Hof, Igelsjön, prästgården, Salunda, Tingmark (TH), Älmestad. Grovare: Grosken, Sjögården. Fänneslunda: Strömshov. Härna: sluttningen mot Gärdsjön, Tissås. S. Ving: Aspanäs, Kärr, Nollyckan, Romsås, Stubben, Tångagärde, Töve. Äspered: Gullestorpsjön, Vatunga. Toarp: Drared, Sjögården, St. Bygd (G).

Stellaria nemorum ssp. ***montana.*** — *Redväg.* Timmele: Kroken. Vist: Nyboholm. Brunn: Brunnsnäs, bäcken mell. Brunnsnäs o. kkn, Kråkeboberg, Remma, St. Ekered. Ulricehamn: Lindängen (G) (Kj), Marbäcksvägen (Ndm). — Kölingared: Åråsa. Hössna: Önnarp. *Kind.* Tvärred: Hjärtsbo, Tvärredslund. Dannike: Rölle. Marbäck: Bäckagården, Korpeboberg, Källebacka, Åsunden vid Korpebo o. Skottek. S. Säm: Fästered, Klevaberget. Hillared: Tåstaberget vid Såken (Hpn). Sexdrega: Skogsgården. *Ås.* S. Ving: Björnkällan, Bogakvarn, Getared, Hästhagen, mell. Madtorp o. Romsås, Sjöbredared, Trogared (G), Tångagärde. Äspered: Hallabron, Sundholmen (S), Vatunga.

S. media. — Allmän.

S. holostea. — *Redväg.* Ulricehamn (Rdb). Spontan?

S. alsine. — T. allmän.

S. palustris. — *Redväg.* Smula: Breskekvarn. N. Åsarp: Alvared, Hagaberg, Hög. Kölaby: Gärdet, Lundby, Rynninge. Humla: Väddåkra. Dalum: stn, Tingvallakärret, Ätran S om kyrkbron. Brunn: Brunnsnäs, Kälkared, Prången. Ulricehamn: gölen nedom Lindängen. — Kölingared (Kj). Böne: vid Ätran. Knätte: 500 m N om byn, Karlslund. *Kind.* Tvärred: Alhammar, Sjöbo. Dannike: Boanäs vid Åsunden. Länghem: Torpa. Finnekumla: Finnekumla gård, Fästered. Marbäck: Bäckagården, Korpebo. Gällstad: Bystadsjön. Hillared: Gälared, Hinnared, Hösjön. Roasjö: St. Apelnäs. Sexdrega: vid Ätran. Månstad (Kj). S. Åsarp: Ladugården. *Ås.* Kärråkra. Möne: Sjöarp. Hällstad: 3 lok. S. Ving: Mogden, Tångagärde. Varnum: Kvarnagården. Äspered: Vatunga.

S. graminea. — Allmän.

S. longifolia. — *Redväg.* N. Åsarp: Valundasjön. Kölaby: Borred. Blidsberg: N om Dalakvarn. Dalum: Krutbrännaregården, Vinsarp. Timmele: Alarp, Kroken. Vist: Nyboholm, Ubbared, S om Vistberget. Brunn: Toppsjön, Åsakullen, Åsunden S om L. Ekered. Ulricehamn: Lindängen. — Solberga: Baggekvarn. Kölingared: 5 lok. Knätte: Björkelund, Lunds by. Liared: Bergabron, vid Jogen, Ubbholmen. Hössna: Hillared. Gullered: Ekesbo (Ndm). Strängsered: Holmö skog (Ndm), Komosse, Norhestra. *Kind.* Tvärred: Alhammar, Linnet, Majblomman, Sjöbo. Länghem: Hovsnäs, Kinnaliden, Torpa, Varred. Finnekumla: Fästered (Kj). Marbäck: 5 lok. S. Säm: Klevaberget. Grönahög: mell. Kvarnared o. kkn. Ljushult: Dalen. Hillared: Hin-

nared, Åsendal. Sexdrega: Handbynäs, Skogsgården. Dalstorp: Boarp, Källerås. Hulared: kkn, Reutersberg (Kj). S. Åsarp: Grytteredsjön. Ljungsarp: Bäckaryd, Kättsjö. *Ås.* Möne: Berget. Murum: Årred. Hällstad: 7 lok. Fänneslunda (Kj). Härna: Anksjön. S. Ving: 9 lok. Tärby: Knallen. Varnum: Annelund, Tåsjön. Rångedala: Sjöbacka, S om stn. Äspered: Gullestorp. Toarp: Gånghester (G), Kilabro (S), Målsryd (G), Tokarpsskogen (G).

Cerastium arvense. — Stadd i kraftig spridning. Uppträder speciellt på åkrar och vägkanter. *Redväg.* N. Åsarp: 9 lok. Kölaby: 5 lok. Humla: Drättekvarn, kkn. Blidsberg: 6 lok. Dalum: 6 lok. Timmele: 7 lok. Vist: skolan, Vistafors. Brunn: Brunnsnäs, Hede. — Fivlered: Karlskoga. Kölingared: Baggekulla, Kölingsholm. Böne: N om kkn, Åfärd. Knätte: Långsered. Liared: N om Gudebo. Hössna: Hjortåsen, Krokstorp. Gullered: 6 lok. Strängsered: stn. *Kind.* Tvärred: Högagärde. Länghem: Haldarp, Torpa. Finnekumla: Sundet. Marbäck: Korpebo. S. Säm: Bossgården. Gällstad: L. Bystad. Hillared: 6 lok. Sexdrega: 7 lok. Månstad: stn. Ljungsarp: Askåker. *Ås.* S. Ving: 6 lok. Varnum: 6 lok. Rångedala: Gravryd. Äspered: kkn, Sundholmen, Vatunga. Toarp: 9 lok.

C. holosteoides. — T. allmän.

C. glomeratum. — *Redväg.* N. Åsarp: Fingerkvarn, Åsarp Rättaregården. Humla: Hoberget. Blidsberg: Kässeberg, Skattegården. Timmele: Bjättlunda. Brunn: Gäla (S), Kälkared. Ulricehamn: kreatursplatsen. — Solberga: kkn. Kölingared: Kölingsholm. Böne: Hällunda. Liared: Oset. Hössna: Brunsered, Hössnatorp, Rönnesmad, Sjöryd. Gullered: Karlabo. *Kind.* Tvärred: Alhammar. Finnekumla: Sundet. Marbäck: Jättebo, kkn. Sexdrega: Götshult. *Ås.* Murum: kkn, Skålarp, Årred. Hällstad: Brunstorp, Hof, Katthög, kkn. Grovare: Sjögården. Fänneslunda: Fänneslundasjön, herrgården, Kullatorp, Strömshov. Härna: prästgården, Skräddaregården, Tissås. S. Ving: 20 lok. Varnum: Kvarnagården, Tångabol. Rångedala: Dränggården, Stavared. Äspered: Vatunga. Toarp: Bygd (G, S).

C. semidecandrum. — *Redväg.* N. Åsarp: Björkelund, Ekeberga, Valunda. Kölaby: Borred, Gärdet, Trädets gård. Humla: Drättekvarn, Hulegården, kkn. Blidsberg: Deragården, Kässeberg. Dalum: 8 lok. Timmele: 6 lok. Vist: bron vid kkn, skolan, Vistaholm. Brunn: Kråkebo. Ulricehamn (G). — Knätte: N om byn, kkn. Gullered: Tissered. *Kind.* Länghem: Haldarp, Torpa. Marbäck: kkn. S. Säm: Bossgården, Ågården. Sexdrega: Buttorp. S. Åsarp: Oppensten (G). *Ås.* S. Vånga: Backabo. Möne: Berget, kkn, Rävike, Tomten. Murum: kkn. Hällstad: Brunstorp, Gammalstorp, Kärragärde, Väby. S. Ving: Backen, Björnkällan, Bogakvarn, Nitta, Tolkabro, Töve. Tärby: Öna. Varnum: Mellsjön, stn. Toarp: kkn (G).

Sagina nodosa. — *Redväg.* Smula: Nya Fagerås. N. Åsarp: Fingerkvarn, Åsen. Kölaby: Stommen (Bgt), Sverkilstorp (sjöarna). Humla: kkn (Bdg). Dalum: Vinsarpsjön, Vång. Timmele: mell. Lena o. Vång. Vist: gölen nedom Lindängen. Brunn: Kälkaredsjön, jvgn vid stn. Ulricehamn (Rdb). — Böne: Lönnern. Knätte: SV om kkn. Hössna:

Brunsered. Gullered: sjöstränder (Ndm). *Kind.* Marbäck: vid Åsunden. S. Säm: Sämsjön. Hillared: Texlesjön. *Ås.* Kärråkra: kkn. S. Vånga: Bosarp. Möne: mossen S om kkn, Rävike. Murum: Aplaberg, Årred. Hällstad: Bredsjön, kkn, L. o. St. Björken (S). S. Ving: Ekeslunda, Hökerum, Mogden, Tolken. Tärby: Finnekumlasjön. Varnum: sjöarna (S). Rångedala: sjöarna. Toarp: Gånghester (G), Sjögårdssjön.

S. subulata. — *Kind.* Nittorp (Rdb). *Ås.* Toarp: Målsryd (S & S), Åsen (G, L, S).

S. procumbens. — Allmän.

[*Arenaria gothica.* — *Redväg.* Ulricehamn (Lindblom 1843; jfr ovan sid. 656).]

A. serpyllifolia. — T. allmän.

Moehringia trinervia. — T. allmän.

Spergula arvensis. — Allmän.

S. vernalis. — *Redväg.* Blidsberg: Kässeberg. *Kind.* Tvärred: Rude. Ljushult: Krokstorpsbergen (G). *Ås.* S. Vånga: Bosarp. Murum: Aplaberg. Hällstad: torp SV om Brunstorp. S. Ving: Svederna. Toarp: Senåsabacken (G).

S. rubra. — *Redväg.* N. Åsarp: Valunda. Blidsberg: stn (ÖN). Timmele: Brostorp. Vist: nya sopstn. Ulricehamn (G). — Hössna: byn (Ndm). Gullered: Sjögared (id.). Strängsered: gästgivaregården (id.). *Kind.* Marbäck: Korpebo (ÖN). S. Säm: Vegby (Kj). Sexdrega: Billeberg (GSn). Ljungsarp: vid gla skolan. *Ås.* S. Ving: Nitta, Säby. Tärby: Finnekumlasjön. Varnum: stn, Väla.

Herniaria glabra. — *Redväg.* Kölaby: SO om Gärdet (i gammalt grustag 1949). Timmele: Annestorp, Kattåkra, Knuve, Kroken (ÖN), kyrkbron 1951, Nygården (G), S om Plate, stn (G, S).

Scleranthus perennis. — *Redväg.* N. Åsarp: Alvared, Ekeberga, herrgården, Valunda. Kölaby: Gärdet. Humla: Drättekvarn. Dalum: Krutbrännaregården, Plate, Silarp. Timmele: Nygården. Vist: brinkarna vid sågen. Brunn: Kråkebo. — Knätte: N om byn, Igelsered. Liared: Brännered, Gudebo, Yttre Lida. Hössna: kkn, Åkesberg (Ndm). Strängsered: stn. *Kind.* Tvärred: Handvik. Dannike: Boanäs. Länghem: Ingestorp. Marbäck: Näsboholm, Åsen. S. Säm: Attorp. Ölsremma: kkn. Ljushult: kkn. Hillared: Påtebo. Sexdrega: Buttorp. Dalstorp: kkn, ålderdomshemmet. Ljungsarp: Ö om byn. *Ås.* S. Vånga: Backabo, Bosarp. Möne: Rävike. Murum: kkn, Munkaberg. Hällstad: Brunstorp, Djupedal, kkn, Lursten. Grovare: Brestorp, kkn. Fänneslunda: Gårdsbo. Härna: Tåbol. S. Ving: Mogden, Romsås, Torp. Tärby: kkn. Varnum: Brogården, kring sjöarna, Väla, Årnäs. Rångedala: Algutstorp, Sjöbacka. Toarp: kkn, Åsen.

S. annuus. — T. allmän.

Agrostemma githago. — *Redväg.* Timmele: Alarp, rågåkrar mell. Dalum o. Timmele, Knape, Knuve. Vist: Hester. — Hössna: Hössnatorp (UB), kkn. *Kind.* Länghem: Hovsnäs. Sexdrega: Skattegården (Tld). *Ås.* Möne: Östergården. Hällstad: torp S om Brunstorp, Sandslätt. Härna: prästgården. S. Ving: Aspanäs, Björnkällan, Hökerum,

Kärrs nabb, Nygården, Romsås, Trogared. Varnum: Ågården. Toarp: Målsryd (Ldg).

Lychnis flos-cuculi. — Allmän.

Viscaria vulgaris. — T. allmän.

Silene cucubalus. — *Redväg.* N. Åsarp: Frugården. Kölaby: vid landsvägen, stn. Humla: jvgshpl., kkn. Blidsberg: kkn. Dalum: Flate, Plate, Silarp, Tingvalla. Timmele: Annestorp, Klockaregården, stn. Vist: vid Ätran (Kj). Ulricehamn: stn. — Kölingared: Ingared. Liared: kkn. Hössna: Holmarp. Gullered: vid jvgn, prästgården (Ndm), Tissered. Strängsered: stn. *Kind.* Tvärred: Högagärde. Marbäck: tunneln. S. Säm: Vegby. Grönahög (Kj). Ljushult: Mariedal. Hillared: vid såväl gla som nuv. stn. Sexdrega: Billeberg, mell. Brokvarn o. Kortö (GSn). *Ås.* Fänneslunda: Solberga. S. Ving: Aspanäs, Trogared (Kj). Varnum: Kvarnagården, vid sjöarna, stn, Väla. Rångedala: kkn, Sjöbacka. Äspered: Vatunga. Toarp: Gånghester, Husåker (G), Kerstinsgärde, Kråkhult, kkn.

S. dichotoma. — *Redväg.* N. Åsarp: kkn. Kölaby: Gärdet (Bgt), Trädet. Humla: kkn. Blidsberg: Dalakvarn. Dalum: kkn, samhället, Silarp, stn. Timmele: Kroken, Lena, samhället. Vist: slakteriet. Ulricehamn. — Böne: Åfärd. Knätte: Lund. Hössna: NO om kkn, Valared. Gullered: Ekeberget 1913 (Ndm). *Kind.* Dannike: Lärjered. Länghem: vid Gärdsjön 1919 (G), samhället 1937, Torpa (näset). Marbäck: Åsundens stn. Hillared: Läggared 1918 (G). Sexdrega: mell. gästgivaregården o. stn 1931 (G), Hjärtared, Kortö (GSn). *Ås.* Möne: Rävike. Härna: Islanda. S. Ving: Aspanäs, Hästhagen, Hökerum, Lottenborg, Nygården 1922, Tångagärde. Varnum: Bossgården, Ågården. Rångedala: kkn 1917 (G). Äspered: kkn, Storegården, Vatunga 1941. Toarp: Hjortryd 1916 (G), Målsryd 1914 (G), Taryd.

S. rupestris. — *Redväg.* Vist: Vistberget. Brunn: Åsakullen. Ulricehamn (S) (Rdb). *Kind.* Länghem: Hökasjön (moränås). Hillared: kkn. Sexdrega: Björsjöberget, Buttorp, Källered. *Ås.* Hällstad: Brunstorp, Hof, Skogsslätt. Grovare: Avelsås, Bergsgärde, Bränning, Högagärde, kkn, Sjögården. Fänneslunda: Kullatorp. Härna: Anksjön, Örsjön. S. Ving: Tolkabro, Töve (G). Varnum: Boarp. Rångedala (G).

S. nutans. — *Redväg.* Smula: moränkulle mell. gla åfåran o. byn, kkn. N. Åsarp: Alvared, V om stn, Åsarp Rättaregården, Åsen. Kölaby: Tummarp, Tåstarp. Humla: Södertorpet. Blidsberg: mell. Hallabo o. Holmen, Ö om Ätran vid kkn. Dalum: Krutbrännaregården, Plate, pkt 174, 2, Silarp, Svenstorp, Vång, Ögården. Timmele: Nöre. Vist: Vistberget. Ulricehamn (S) (Rdb). — Kölingared: Baggekulla, Kölingsholm (S). Liared: kkn (Ndm). Hössna: Krokstorp, nära skjutbanan. Gullered: Sjögared (id.). *Kind.* Länghem: Torpa (G). Sexdrega: jvgn vid Hagalundsjön (GSn). Månstad: kkn (Hård). S. Åsarp: Oppensten. *Ås.* Kärråkra: Sjö. Hällstad: Djupedal, Hof, Älmestad. Grovare: S om folkskolan (B). S. Ving: Backen, Bogakvarn, Hökerum, Skogsbol, Tolkabro, Vätersholm. Varnum: Kvarnagården, Ågården. Rångedala: Falskog. Äspered: Vatunga. Toarp: Häljared, Skenstad, V om stn.

Melandrium noctiflorum. — *Redväg.* Blidsberg: Dalakvarn, präst-

gården. Dalum: Krutbrännaregården. Timmele: Knape, stn. Brunn: Åsakullen. *Kind.* Länghem: Haldarp. *Ås.* Härna: prästgården. S. Ving: Aspanäs, prästgården. Äspered: Leatorp, Vatunga.

M. album. — *Redväg.* Smula: kkn, L. Fagerås, Stommen. N. Åsarp: Alvared, Hög, kkn, Ågården, Åsarp Rättaregården. Kölaby: Boarp, Brunnsgården, SO om Gärdet, Rynninge, Trädets gård. Humla: kkn. Blidsberg: Dalakvarn, Holmen, kkn. Dalum: kkn, Plate, stn. Timmele: Frännarp, Lena, stn, Vång. Brunn: Brunnsnäs, Brämmesås. — Kölingared: Kölingsholm. Böne: Åfärd. Knätte: kkn. Hössna: åkrarna kring kkn. Gullered (Ndm). *Kind.* Dannike: kyrkbyn. Hillared: Hinnared. *Ås.* Murum: Rya. Hällstad: kkn, SV om kkn (TH), Älmestad. Härna: prästgården. S. Ving: Aspanäs, kkn, stn. Varnum: stn. Rångedala: Bredared, Gretlanda. Toarp: Bygd (G), Häljared.

M. album* × *rubrum. — *Ås.* S. Ving: kkn 1 ex. 1926. Toarp: Bygd 1893 (G).

M. rubrum. — *Redväg.* Kölaby: Trädets gård. Vist: Ubbarp (ogräs). Brunn: Kråkeboberg. Ulricehamn: Lindängen. — Kölingared: Valshalla. Liared: Tuskan (Ndm). *Kind.* Länghem: Torpa. Finnekumla: Fästered, Sundet. Marbäck: Korpeboberg, bäcken vid kkn. S. Säm: Klevaberget, Vegby. Grönahög: Holmö (Ndm). *Ås.* Möne: Östergården. Hällstad: Hof. S. Ving: Aspanäs, Bogakvarn, kkn, Madtorp, Sjögården, Tolkabro, Tångagärde. Rångedala: bäcken vid Algutstorp, Gravryd, stn. Äspered: Sundholmen, Vatunga. Toarp: Slätthult (G), Tummarp.

Vaccaria pyramidata. — *Ås.* Härna: Sassarp (rågåker) 1924. S. Ving: Hökerums stn 1925.

Saponaria officinalis. — *Redväg.* Smula: L. Fagerås, Smula åsar. N. Åsarp: på gla jvgsbanken (rikl.), prästgården. Kölaby: Borred, Gärdet. Vist: nya sopstn. Ulricehamn: kreatursplatsen. — Solberga: korsvägen S om kkn. Fivlered: kkn. Knätte: kkn. Liared: Ubbholmen. *Kind.* Länghem: Rings mosse (jvgsbank) 1918 (B). S. Åsarp: Limmared. *Ås.* Kärråkra: kkn, Öjelunda. Hällstad: prästgården (TH), Älmestad. S. Ving: Romsås.

Dianthus deltoides. — *Redväg.* N. Åsarp: Alvared, Drättekvarn, Åsen. Kölaby: SO om Gärdet, Sverkilstorp (åsen). Humla: vägkant N om kkn. Blidsberg: Dalakvarn, Deragården, 300 m Ö om kkn. Dalum: Krutbrännaregården, kkn. Timmele: samhället, stn (TH). Vist: kkn, nya kyrkogården. Brunn: Brunnsnäs. — Solberga: kkn. Fivlered: kkn. Kölingared: Kölingsholm. Knätte: kullarna 500 m S om kkn. Hössna: kkn. *Kind.* Marbäck: Bredgården. S. Säm: Vegby. Ljushult: Aplared. Hillared: gla stn. Sexdrega: mell. Brokvarn o. Kortö (GSn), Buttorp, bron Ö om kkn (Hpn). *Ås.* Murum: Skålarp. Fänneslunda: Gårdabo, Karstorp. S. Ving: Bogakvarn. Varnum: vid Mellsjön, stn. Rångedala: Dränggården. Toarp: Gånghester (G).

Nymphaea alba. — Allmän.

N. candida. — *Redväg.* Dalum: Viesjön (det. C. Blom), Vinsarpsjön (G). Brunn: Toppsjön. *Kind.* S. Åsarp: Grytteredsjön (det. C. Blom). *Ås.* Toarp: Flage mader i ån mot Kovra (G).

Nuphar luteum. — Allmän.

***N. luteum* × *pumilum*.** — *Redväg.* Dalum: Viesjön (G), Vinsarpsjön (S) (det. C. Blom).

***Aquilegia vulgaris*.** — Mångenstädes förvildad.

[*Thalictrum minus*. — *Redväg.* N. Åsarp: mell. Trädet o. Åsarp (Rdb). Ulricehamn 1782. Jfr sid. 653.]

***Th. simplex*.** — *Redväg.* Smula: L. Fagerås, bron över Skråern, åsarna. N. Åsarp: Alvared, Ekeberg, Frugården, N om Åsen. Kölaby: Borred, Danstorp, mell. Åsen o. pkt 221, 9. Humla: N om kkn. Blidsberg: Dalakvarn, vid vägen mot Dalum, Kässeberg (baktrågen). Dalum: NV om Ambjörnarp, Björkestorp, sjön S om kkn, Ätran N om kkn, Nöresjön, Plate, Rom, Silarpskullen, S om Stommen, Tingvallakärret, Vång, Ögården. Timmele: Kroken (brinkarna). Vist: Ubbarp, Åsunden. Brunn: Kråkebo, Kälkared, Röstesjön. — Solberga: N om kkn. Böne: Ö om prästgården. Knätte: kullarna 500 m S om kkn. Hössna: Krokstorp, källaren N om prästgården, skjutbanan, Torpet, Valared. Gullered: Sjögared (Ndm). *Kind.* Länghem: Gärdsjön (G, S), Torpa. Finnekumla: Sundet. Marbäck: vid landsvägen mot Gällstad (H. Helmrot). S. Säm: Attorp. Sexdrega: Hagalundsjön (G), Lockryd. Dalstorp: Boarp. *Ås.* Kärråkra: kkn, Sjö. Möne: kkn, mossen S om kkn, Sjöarp. Hällstad: Gammalstorp (S), Hof, Snugge, Älmestad. Fänneslunda: Karstorp, kkn, Sotared. S. Ving: Bogakvarn, Fäbroarna, Nitta, Röstekärr. Varnum: Kvarnagården, Nitta, stn. Toarp: Germundared (G), sjön S om kkn.

***Th. flavum*.** — *Redväg.* Smula: Breskekvarn, Ätran N om byn. N. Åsarp: Alvared, Ekeberga kvarn, Fingerkvarn, kkn, Skägga (moränkulle vid Ätran), Valundasjön, Väberga kvarn. Dalum: gölen S om kkn, Vinsarp. Vist: Snipe, Åsunden. Brunn: Brunnsnäs (S), St. Ekered. Ulricehamn: Lindängen, Prången, Åsunden. — Solberga: Baggekvarn. Kölingared: Jogen, Kölingsholm. Böne: Björkås, N om kkn, Lönnern (Kj), vid Ätran. Knätte: Ätran. Liared: N om kkn, Nolsjön. Hössna: Grubbäcken, Önnarp. Gullered (Ndm). *Kind.* Tvärred: Högagärde, SO om Ruggebo. Dannike: Åsunden vid Boanäs. Länghem: Torpa, öar i Yttre Åsunden (G, S). Finnekumla: Sundet. Marbäck: Bredgården, bäcken genom byn, Hyared, Källebacka, Åsunden S om stn. Gällstad: Bystad, Intorp. Hillared: Gälaredsån, Påtebo. Sexdrega: Kortö kvarn (GSn). S. Åsarp: ån vid kkn. *Ås.* Kärråkra: kyrkbyn. S. Vånga: Rosendal. Murum: Skålarp. Härna: Sassarp. S. Ving: Aspanäs, Nitta, Nollyckan, Säby, vid Tolken. Varnum: Björkudden, Kvarnagården, Marsjön, stn, Ågården. Rångedala: Marsjön. Äspered: Vatunga.

***Actaea spicata*.** — *Redväg.* Humla: åsryggar vid Ätran NO om kkn, Väddåkra (ÖN). Blidsberg: Dalakvarn, Kässeberg (baktrågen). Dalum: Vinsarp, Vång. Timmele: Knuve. Vist: Vistberget. Brunn: Kråkeboberg, Remma, Åsakullen. Ulricehamn: Lindängen (G). — Kölingared: Valshalla. Hössna: Halla. Gullered: Hultagärde. *Kind.* Tvärred: Alhammar. Dannike: Rölle. Länghem: Kinnaliden, Torpa. Finnekumla: Sundet. Marbäck: Bäckagården (Kj), Korpeboberg, Kärrabo, Skottek, Stensered. S. Säm: Attorp, Klevaberget. Grönahög: Holmö (Ndm), Högaberg, Torsberg, Östentorp. Ljushult: Hallared (G). Hillared: Läggared (Hpn). Sexdrega: Björkås (id.), Björsjöberg (id.). *Ås.* S. Ving:

Källarnabben, Sjöbredared, Töve. Varnum: Boarp. Rångedala: bäcken nedom Algutstorp, Klockaregården, N om stn. Äspered: Vatunga. Toarp: Slätthult (G, S), Älmås.

Caltha palustris. — Allmän.

Trollius europaeus. — Vanlig i *Redväg* o. *Ås* samt i Kind i socknarna kring Åsunden. F. ö. sällsynt. *Kind.* Dannike: 5 lok. Länghem: Torpa. Gällstad: 6 lok. Grönahög: 4 lok. Ölsremma: Grebbaslätt, Åremma. Ljushult: Aplared, Stommen. Hillared: 6 lok. Sexdrega: 4 lok. Månstad: Björdal. Dalstorp: Boarp, Älmås. Hulared: Lund, Sjörred, Stålared. S. Åsarp: Ladugården.

Anemone hepatica. — T. sällsynt i hela södra Västergötland, dock förhållandevis vanlig i socknarna kring Åsunden. *Redväg.* Humla: Smedsgården. Blidsberg: Dalakvarn, Hallabo, Kässeberg (baktrågen). Dalum: Nöre, Plate, Silarp, Vinsarp. Timmele: Blankared, Kattåkra, Knuve, Kroken. Vist: Fotåsen, Härstorp, Ubbarp, Vistberget. Brunn: Gäla, Kråkeboberg, Kälkared, Tranegärde, Åsakullen. Ulricehamn (Rdb). — Kölingared: Ingared, Kölingsholm, Valshalla. Böne: Marbohemmet, prästgården. Knätte: Igelsered, Köpmantorp. Liared: Tuskan. Hössna: Amurbacken, Brunsered, Halla, Hjortåsen, kkn, Sillebacken, Sjörred, Önnarp. Gullered: Ekesbo (Ndm), Hultagärde. Strängsered: Kimmarebo. *Kind.* Tvärred: 6 lok. Dannike: Boanäs, Rölle, Stuvhult. Länghem: Hovsnäs, Kinnaliden, Torpa. Finnekumla: Fästered, Närarp, Sjöbo, Sundet. Marbäck: 10 lok. S. Säm: Attorp, Klevaberget. Gällstad: Hjortsbacka. Grönahög: 5 lok. Ljushult: Backa, Dalen. Sexdrega: Björkås (Tld), Björsjöberg, Brattåsen (GSn), Handbynäs, Högagärdet (Hpn), Sandsjönäs, Skogsgården. Månstad: Björdal. S. Åsarp: Ladugården. Nittorp: Rya. *Ås.* Hällstad: Ambo (TH). Grovare: Bergsgärde, Sjögården. Fänneslunda: Kartryd, Sotared, Strömshov. S. Ving: 9 lok. Tärby: sluttningen mot Finnekumlasjön. Varnum: Kvarnagården, Nitta. Rångedala: 6 lok. Äspered: Dalshester, Hägnagärde, Sundholmen, Sägryd, Tångagärdshage. Toarp: 9 lok.

A. nemorosa. — Allmän.

A. nemorosa* × *ranunculoides. — *Redväg.* — Hössna: Grubbäcken (G). *Ås.* S. Ving: Hästskoslätt (G). [Lokalen S. Ving: Tångagärde (S & S) skall utgå. Felbestämning, det. C. Blom.]

A. ranunculoides. — *Redväg.* Timmele: Knuve, Kroken (brinkarna vid Ätran), längs bäcken Redvägsborg—Knalten, Sjöbacka. Vist: längs vägen Hössna—Ulricehamn, Svensholm, Ubbarp. Brunn: Bokeberget, bäcken mell. Brunnsnäs o. kkn, Hede, Kråkeboberg, sänkan mell. Kråkeboberg o. Åsakullen, Kälkared, L. Ekered, prästgården, Remma, St. Ekered, Torestorp. Ulricehamn: Brunnsbo, Hössnavägen (G), Liljedal, L. Skottek, Lindängen, utmed vägen till Pinebo, S om stadsparken. — Kölingared: Ingared, Lönnarps ängar, Torpa. Böne: bäcken vid kkn, Åfärd vid Ätran. Knätte: Igelsered. Hössna: Brunsered, Duvered, Grubbäcken, Halla, Hillared, Hjortåsen, bäcken 500 m V om Hjortåsen, Holmarp, Ryaskogen, Sillebacken, Valared Yttergården, mell. Önnarp o. Oset. *Kind.* Tvärred: Hand, Majblomman, Tvärredslund. Dannike: Rölle (G, S), Slätten, Stuvhult. Länghem: näset mell. Hovsnäs o. Torpa. Finnekumla:

Sundet, Ängsön. Marbäck: Bredgården, dalgången NO om Bredgården, längs bäcken från Hyared till byn, Korpebo, Källebacka, Kärrabo, Skottek, Stensered. S. Säm: torpet Sjöbo vid Sämsjön. *Ås.* S. Ving: Arvidsgården, Backen, Björnared, Björnkällan, Bogakvarn (G, S), Bryggaregården, Ekeslunda, Fäbroarna, Getared, Horsared, Hule, Hästhagen (S), Hästskoslätt, Intakan, kkn, Nitta, Romsås, Räfsered, Sjöbacka, Torp, Trogared (G, S), Tångagärde. Rångedala: vid bäcken Algutstorp—jvgn, Buttorp. Äspered: Sjötorp, Sundholmen (G), Sägryd, Tångagärdshage, Vatunga (G). Toarp: Skenstad (S), Stålarp (G, S). — Jfr Westfeldt 1936. — Karta (fig. 7).

A. vernalis. — *Redväg.* N. Åsarp: Björkelund, Fingerkvarn, heden S om kkn. Kölaby: Borred (Bgt), Frugården, Tummarp. Humla: Drättekvarn, kulle N om kkn. Blidsberg: folkskolan. Dalum: Krutbrännaregården, Källeberg, stn 1893 (S), Svenstorp (ÖN), Vinsarp (S. Kjöllerström). Timmele: Kattåkra (ÖN), Källeberg, Nygården, prästgården, Torvås. Vist: skjutbanan. — Kölingared: Kölingsholm, Udden (Hugo Rehn). Knätte: mell. byn o. Åfärd. Liared: S om kkn. Hössna: Kinnared. Gullered: Ekesbo (Ndm), Olsbo (id.). *Kind.* Gällstad: Källebo (Kvl). Hillared: Hösjön (Kj), Ätralund (Tld). Sexdrega: Björkås, Hagalundsjön (Hpn!), mell. Hestra o. Hestrasjön (Folke Rösiö), Holmåkra, Kråkebacken (Hpn), Nybygget (id.), Smedsåsen (id.). Månstad: Björnarp (Rdb). S. Åsarp: Limmared (G, S). *Ås.* Möne: Östergården (B). Hällstad: Brunstorp, Snugge. Härna: Bondarp. S. Ving: Kärrs nabb. Rångedala: Falskogs källa (S, G), Gravryd, Sandlid, längs gla landsvägen till Varnum. Toarp: Germundared (S), kkn (G).

A. pulsatilla. — Allmän i Ätradalen N om Åsunden. F. ö. antecknad från *Redväg.* Solberga: åsen vid kkn. Fivlered: kkn, Ramsberg, St. Loppås. Kölingared: Marbohemmet, Torpa, Valshalla, Årås. Böne: moränkulle N om kkn, Marbohemmet, Åfärd. Knätte: moränkullarna S om kkn. Liared: 6 lok. Hössna: 7 lok. Gullered: Sjögared. Strängsered: Häggarpet, kkn, Tissered. *Kind.* Tvärred: Högagärde. Länghem: Haldarp, Torpa, Ömmesala. Finnekumla: Sundet. Marbäck: byn, Källebacka, Storegården. S. Säm: Attorp, Bossgården, Vegby. Gällstad: Bystadsjön (Kj!), prästgården. Grönahög: Högaberg. Ölsremma. Ljushult: Arnäsholm. Hillared: 6 lok. Sexdrega: 8 lok. Månstad: kkn. Dalstorp: Boarp, kkn. Hulared: kkn. S. Åsarp: Limmared, Sjörred, Skårtebo. Ljungsarp: Askåker, Björstorp, Sassarp. *Ås.* Kärråkra: kkn (G), Ryagärde, Sjö. S. Vånga: Rosendal. Möne: Givarp, Tomten. Murum: Ryda, Skålarp. Hällstad: Gisslarp, kkn, Pjukarp (S), V om prästgården (TH), Sandslätt, Snugge. Fänneslunda: Gälabo, Kartryd, Solberga. Härna: Bondarp. S. Ving: 8 lok. Tärby: kkn, Ässtorp. Varnum: Bossgården, Dållebo (Kj), Kvarnagården, Ågården, Årnäs. Rångedala: 6 lok. Äspered: saknas helt. Toarp: Bygd (S), Häljared, kkn, Ottersmad.

Ranunculus peltatus. — T. allmän.

R. trichophyllus. — *Redväg.* Smula: nygrävt dike 500 m Ö om byn. Dalum: Ögården. — Kölingared (Kj). Böne: Ätran Ö om kkn. *Kind.* Länghem: Forsa (i Ätran) (G). *Ås.* S. Vånga: Vånga by. Möne: dike till Ömmern (S). Murum: Ö om Kyrkeberg (TH). Hällstad: Katthög

(TH), Lursten (G), Munkeboda (S), S om prästgården, Tingmark (offerkällan) (S), SV om Skattegården (TH), Vrångebjörk (TH). Toarp: Häljared (G, S), kkn (G), St. Bygd (G).

R. sceleratus. — *Redväg.* N. Åsarp: Alvared, Åsarp Rättaregården. Blidsberg: SV om Påarp, jvgsdike N om stn. Dalum: Vedåsa, Vång. Timmele: Bjättlunda, Kattåkra, Klockaregården, Nygården. — Hössna: kkn, Önnarp. *Kind.* Tvärred: Rude. *Ås.* S. Vånga: Rosendal. Möne: Sjöarp (TH). Hällstad: Djupedal, Hof, prästgården (S), SV om Skattegården (TH). Grovare: Sjögården. Härna: Tissås, Tåbol. S. Ving: Hökerum, kkn, Säby. Tärby: Finnekumlasjön. Varnum: sjöarna.

R. auricomus. — T. allmän.

R. cassubicus. — Adventiv. *Redväg.* Kölingared: Vållered.

R. acris. — Allmän.

R. repens. — Allmän.

R. polyanthemus. — *Redväg.* Smula: moränkulle S om kkn. N. Åsarp: 12 lok. Kölaby: Danstorp, Lundby, Sverkilstorp, Tummarp, Tåstarp. Blidsberg: Brolyckan, Dalakvarn, Danstorp, Deragården, S om kkn, Kässeberg (baktrågen). Dalum: 12 lok. Timmele: 10 lok. Ulricehamn 1782 (G). — Knätte: kkn, moränkullarna 500 m S om kkn. Hössna: Hössnatorp, Krokstorp. Gullered: bygärdet (Ndm). *Kind.* Marbäck: strax S om kkn, Storegården (idrottsplanen). *Ås.* Möne: Rävike, Torkilstorp, Östergården. Murum: Skålarp. Hällstad: Gammalstorp (TH), Hof, Älmestad. Härna: byn. S. Ving: Nollyckan, Nygården, Svederna, Töve. Varnum: Bossgården, Varnum.

R. bulbosus. — *Redväg.* N. Åsarp: heden S om kkn. Kölaby: Gärdet. Humla: moränkulle NO om kkn. Blidsberg: jvgn N om stn. Dalum: kkn, Plate. Timmele: Nöre. Vist: Brogården (Slottet). — Knätte: kkn, kullarna 500 m S om kkn. Liared: Holmåkra, kkn. Hössna: prästgården (Ndm). Gullered: Sjögared (id.). *Kind.* Länghem: Torpa. Ljushult: Kovra bankar. Sexdrega: Buttorp, stn. *Ås.* Hällstad: kkn. Varnum: grustaget N om stn. Toarp: kkn (G).

R. flammula ssp. ***eu-flammula.*** — Allmän.

R. flammula ssp. ***reptans.*** — *Redväg.* Smula: Breskekvarn. Kölaby: Yttern (Bgt). Dalum: Nöresjön, Vinsarpsjön. Åsundens stränder. — Kölingared: Lönnern. Gullered o. Strängsered: Strängseredsjön. *Kind.* Åsunden. Länghem: Borgasjön, Sävsjön. S. Säm: Sämsjön. Gällstad: Rånnavägsjön. Grönahög: St. Oxsjön. Ölsremma: sjön Trehörningen (Old). Ljushult: Lysjön (G). Hillared: Björsjön, Hultet, Hösjön. Månstad: Tapplesjön. Dalstorp: sjön vid kkn. Hulared: Grytteredsjön. *Ås.* Hällstad: Bredsjön (TH), L. o. St. Björken. Grovare: Grosken. S. Ving: Angsjön, Mogden, Tolken. Varnum: sjöarna. Äspered: Tolken.

R. lingua. — *Redväg.* Spridd längs Ätran från Solberga: Baggekvarn via Smula ned till Dalum: Platekvarn. Dessutom vid N. Åsarp: Ekeberga kvarn. Dalum: Viesjön (TH). Dalum o. Böne: Ätrans utlopp i Vinsarpsjön. Timmele: Bredsjön, Kroksjöarna o. diket mell. dessa. — Kölingared: i Tidan. *Kind.* Hillared: Spångasjön. *Ås.* Möne: Viesjön, Ömmern (TH). Murum: Skålarp (TH), Ömmern (TH). Hällstad: Björ-

kensjöarna (S), Bredsjön (S). Härna: Gärdsjön o. Viskan (S & S). S. Ving: Angsjön. Varnum: Viskan (Brogården—Kvarnagården—Ågården).

R. ficaria. — Allmän i socknarna kring Tolken o. Åsunden. Eljest sällsynt. *Redväg.* Kölaby: Stommen. Dalum: Plate, Silarpsbäcken, Vinsarp. Timmele: Annestorp, V om samhället, Sjöbacka. Vist: Ubbarp, Vistberget. Brunn: 12 lok. Ulricehamn: flerst. — Kölingared: Torpa, Valshalla, Årås. Böne: Marbohemmet. Hössna: Hjortåsen, mell. Önnarp o. Öset. Strängsered: Kimmarebo (Ndm). *Kind.* Tvärred: 4 lok. Dannike: Rölle, Stuvhult. Länghem: Hovsnäs, Husön, Torpa. Finnekumla: Lindevik, Närarp, Sundet, Ängsön. Marbäck: 11 lok. S. Säm: Bossgården, Fästered, Sjörred. Gällstad: Bystad, Intorp. Sexdrega: Björkås (Hpn), Götshult, Sandsjönäs, Skogsgården. *Ås.* Hällstad: Dannarp, Hof, prästgården. Grovare: Bergsgärde. Fänneslunda: Kartryd, Kullatorp, Solberga. Härna: prästgården, Sassarp. S. Ving: 24 lok. Varnum: Boarp. Rångedala: Algutstorp, Gravryd, Holmen. Äspered: 10 lok. Toarp: 9 lok.

Myosurus minimus. — *Redväg.* Dalum: Vedåsa (på berghäll). *Ås.* Hällstad: Hof, prästgården (TH). Äspered: Vatunga 1944.

Berberis vulgaris. — *Redväg.* Dalum: Vinsarp 2 ex. (ÖN!). Timmele: jvgn S om stn (Nore Lidén). — Liared: Skeppsholmen 1 ex., Ubbholmen 1 ex. *Kind.* Tvärred: Högagärde 1 ex. Länghem: Torpa 1 ex. *Ås.* S. Ving: Hökerum (TH), kkn 1 ex. Varnum: Dållebo (i skog) (Lidén). Äspered: Hägnagärde, vid gla vägen kyrkbyn—Vatunga, Leatorp, Lerbäck, Sundholmen, SV om Åsen. Toarp: Bygd (G).

Chelidonium majus. — *Redväg.* Kölaby: Borred, kkn. Blidsberg: Björnarp, Kässeberg (baktrågen). Dalum: kkn, mell. kkn o. Ögården, S om kkn, Rom, Silarp. Timmele: Nöre (brinkarna), Redvägsborg. Vist: banvaktsstugan, nya kyrkogården, nya sopstn, Ubbarp. Brunn: Toppsjökullen. Ulricehamn: Lindängen, stn. — Kölingared: Kölingsholm, Årås. Liared: Bäckalid. Hössna: kkn. Gullered: småskolan (Ndm). *Kind.* Tvärred: Högagärde, Tvärredslund. Länghem: kkn, Torpa. Finnekumla: Fästered, Sundet. Ljushult: Arnäsholm, Backa, St. Apelnäs. Hillared: Gälared. *Ås.* S. Vånga: Rosendal. S. Ving: Högryd, Madtorp, Romsås, Tolkabro, Tomta, Torp. Varnum: Dållebo, Nitta, Ågården. Rångedala: Byttorp, Falskog, Finnekumla. Äspered: Sundholmen. Toarp: Häljared, kkn.

Papaver dubium. — *Redväg.* Humla: utmed vägen mot Blidsberg. Blidsberg: kkn, ullspinneriet. Dalum: Gustavsberg (jvgn), Krutbrännaregården, Plate, samhället. Timmele: stn. Brunn: jvgn vid stn. — Gullered (Ndm). *Kind.* S. Åsarp: Limmareds stn. *Ås.* S. Ving: jvgn vid Röstemad.

P. argemone. — *Redväg.* Vist: Prången (ÖN). Brunn: jvgn vid stn. *Ås.* Rångedala: vid bäcken nedom Algutstorp, Ö om Finnekumla.

P. rhoeas. — *Redväg.* Timmele: Frännarp. Vist: nya sopstn 1953. *Kind.* Sexdrega: Ringestenavägen (Hpn).

P. somniferum. — *Redväg.* Dalum (Ndm). *Ås.* Härna: Skräddaregården 1929.

Corydalis fabacea. — *Redväg.* Blidsberg: Kässeberg (baktrågen).

Dalum: Nöre, Vång. Vist: SV om Hedegården. Brunn: Kråkebo, Kråkeboberg, Kälkared, Remma, Åsakullen. Ulricehamn: Lindängen. — Kölingared: Kölingsholm. *Kind.* Tvärred: Alhammar, Högagärde, Tvärredslund. Dannike: Rölle (G). Länghem: Hovsnäs. Finnekumla: Fästered, Ängsön. Marbäck: Kärrabo, Storegården (UB). Ljushult: Hallared (E. Ränge). Sexdrega: Björkås (GSn), Skogsgården. *Ås.* S. Ving: Hökerum (dalen), Romsås, Torp, Tångagärde, Öv. Hule. Rångedala: Finnekumla. Äspered: Gullestorp, Sundholmen, Vatunga. Toarp: Lövedal (Helge Haglund).

C. solida. — *Ås.* S. Ving: Tångagärde (fv.). Toarp: Bygd (fv.), St. Bygd (S) (odl. o. fv., i rik mängd).

Fumaria officinalis. — T. allmän.

Brassica campestris. — Ej konsekvent antecknad. — *Redväg.* Timmele: Mölnarp, Nöre, Sjöbacka, Vång. Brunn: Kälkared. Ulricehamn 1782. — Hössna: Krokstorp. Gullered: Ubbared. *Kind.* Dannike: kyrkbyn. S. Säm: Attorp (Kj). Gällstad: Rånnaväg, St. Bystad. *Ås.* Hällstad: Brunstorp, Sandslätt, Väby. Grovare: Avelsås, Sjögården. Härna: kyrkbyn. S. Ving: 10 lok. Varnum: stn. Äspered: Vatunga. Toarp: Häljared, Målsryd.

B. nigra. — *Redväg.* Vist: nya sopstn. — Kölingared: Kölingsholm 1925.

Sinapis arvensis. — Allmän.

S. alba. — *Redväg.* Dalum (Rdb). Brunn: Hede 1953. *Kind.* Länghem: Haldarp 1923.

Raphanus raphanistrum. — Ej konsekvent antecknad. *Redväg.* Dalum: stn, Vinsarp. Timmele: Bjättlunda. Brunn: Brämmesås, Skogen, stn. — Kölingared: kkn, Kölingsholm, Stensered. Böne: N om kkn. Knätte: Långsered. Liared: kkn. Gullered: Karlabo. *Kind.* Tvärred: Ö om Bodarna, Kärrabo. Dannike: Backa, Hult, kyrkbyn, Lugnet. Länghem: Torpa. S. Säm: Vegby. Gällstad: Rånnaväg. Sexdrega: Björsjöberg. Dalstorp: Långared. Nittorp: Moghult. *Ås.* Kärråkra: Sjö. Hällstad: Brunstorp, Snugge, Väby. Grovare: 6 lok. Fänneslunda: kkn. Härna: Hult, Sassarp, Tissås. S. Ving: 12 lok. Varnum: kkn, vid Mellsjön. Rångedala: Holmen, Vevelhult. Äspered: Hinnaredsslätt, Sundholmen, Vatunga. Toarp: Drared, Häljared, Målsryd (S).

R. sativus. — *Ås.* S. Ving: Håkabo (i linåker) 1924.

Lepidium campestre. — *Ås.* Toarp: Kovra bankar 1919 (G), St. Bygd 1906 (G).

L. densiflorum. — *Redväg.* N. Åsarp: stn. Dalum: stn (G). Timmele: stn. Vist: nya sopstn. Ulricehamn: stn (G). *Kind.* S. Säm: Vegby stn. S. Åsarp: Limmared (glasbruket, stn). *Ås.* S. Ving: Aspanäs stn, Hökerums stn, Tolkabro (vägkant). Äspered: Vatunga (ogräs, 1940). Toarp: Dalsjöfors stn.

L. ruderale. — *Redväg.* Ulricehamn 1782.

Thlaspi arvense. — Allmän.

Th. alpestre. — *Redväg.* N. Åsarp: Slättåkra. Dalum: Vinsarp. Timmele: jvgn vid Annestorp. Ulricehamn: stn (ÖN). *Kind.* Dannike: Stålåsen. Länghem: Ingsvallen (ÖN). Marbäck: Korpebo (ÖN), pkt

217, 2. Ljushult: Glavsered (1913 A. O. Olson), Skräddaretorpet. Hillared: Hinnared. Sexdrega: Björkås, stn, S om Buttorp (jvgn), Stålabo. *Ås.* S. Ving: Nitta. Varnum: Årnäs. Äspered: kkn, mell. kkn o. Gullestorp, Sjötorp, Sägryd, Vatunga. Toarp: Bygd 1906 (G), dalen mell. Bygd o. Målsryd, Dalsjöfors, Drared, Hjortryd, Kovra (G), kkn, Målsryd, Skenstad, Taryd, Tubbared, Tummarp.

Teesdalia nudicaulis. — *Kind.* Länghem: Kinnaliden 1952 (G). *Ås.* Toarp: Målsryd (jvgn) (G).

Capsella bursa-pastoris. — Allmän.

[*Hornungia petraea.* — *Redväg.* Vist: Vistberget (Lindblom 1843). Jfr sid. 656.]

Subularia aquatica. — Tolken o. Åsunden. *Redväg.* Dalum: Nöresjön. — Gullered o. Strängsered: Strängseredsjön. *Kind.* S. Säm: Sämsjön. Hillared: Veka bro (Hpn). Sexdrega: sågen (Hpn). *Ås.* S. Ving: Mogden, Tolken. Äspered: Tolken (G).

Bunias orientalis. — *Redväg.* Smula: åsarna. N. Åsarp: 8 lok. Kölaby: Gärdet, Sverkilstorp. Dalum: vid kkn, mell. Lena o. Nöre, Nöresjön. Timmele: 8 lok. Ulricehamn: Lindängen. — Solberga: Baggekvarn, kkn, åsen S om kkn. Liared (Kj). Hössna: Kullen (Hård), Oset. Gullered: kkn. *Kind.* Tvärred: Kalvshester. Marbäck (Hård). Sexdrega: kkn (under många år) (G). *Ås.* Möne: Rävike. Hällstad: NO om kkn, Skattegården. S. Ving: Nygården (S). Äspered: Vatunga. Toarp: Drared.

Alyssum alyssoides. — *Redväg.* Dalum: Tingvalla. Vist: Prången (jvgn). *Ås.* Varnum: grustaget N om stn 1937—38.

Berteroa incana. — *Redväg.* Smula: åsarna. Timmele: stn. *Kind.* Marbäck: jvgn vid Korpebo 1 ex. 1949, Åsundens stn. S. Säm: Vegby stn. Gällstad: Frölunda. Sexdrega: Sandsjön (G, S). *Ås.* Varnum: stn 1950. Rångedala: kkn.

Draba verna. — T. allmän.

Armoracia rusticana. — *Redväg.* Kölaby: Trädet (i ån). Dalum: Vinsarp (S). Timmele: samhället. Vist: nya sopstn. Brunn: Hede, Kråkebo, stn. *Kind.* Finnekumla: Ängsön (sjöstrand). Månstad: Björdal. *Ås.* Möne: Bolstorp. Härna: Björnsgården, prästgården. S. Ving: Ekeslunda, Hökerum, kkn, Romsås, St. Högryd, Töve. Varnum: Lättorp. Äspered: Sjötorp (i bäcken).

Cardamine bulbifera. — *Redväg.* Brunn: Kråkeboberg, Åsakullen. Ulricehamn (B) (Rdb). — Liared: Tuskan (Ndm). *Kind.* Dannike: Rölle. Länghem: Torpa. Marbäck: Näsboholm, Stensered. S. Säm: Klevaberget. Grönahög: Högaberg (Kvl!). *Ås.* S. Ving: Romsås. Äspered: Hägnagärde, Sundholmen (S), Tångagärdshage. Toarp: Skinnarehult (L).

C. impatiens. — *Redväg.* Blidsberg: Kässeberg (baktrågen). Timmele: Kattåkra, Knuve. Vist: Vistberget. Brunn: Kråkeboberg, Åsakullen. Ulricehamn: Lindängen (uppgiven redan 1782). *Kind.* S. Säm: Klevaberget. *Ås.* S. Ving: Bogakvarn (S & S).

C. hirsuta. — *Ås.* Toarp: Berget (L), Ramnaberget (G).

C. flexuosa. — *Redväg.* Brunn: Kråkeboberg, Åsakullen. Ulrice-

hamn (G). *Kind.* Marbäck: Korpebo (ÖN). Gällstad: Källaboskogen vid Toppåsasjön (H. Helmrot). *Ås.* S. Ving: Öndared. Toarp: Djupedal (G), Germundared (B), dalen N om Gånghester (CSg), mell. Gällsjon o. Kulla (G), Målsryd (G, S), St. Sälgsjön (S) (Rdb), Åsen (G).

[*C. parviflora.* — *Ås.* Toarp: Gånghester (Westfeldt 1929). Uppgiften skall utgå. Enligt C. Sandberg föreligger en förväxling med *C. flexuosa.*]

C. amara. — *Redväg.* N. Åsarp: Valunda. Kölaby: Lundby. Humla: Drättekvarn, Haberget, Väddåkra. Blidsberg: Deragården, N om stn. Dalum: 5 lok. Timmele: 3 lok. Vist: 3 lok. Brunn: Långsered, Toppsjöbacken. Ulricehamn: 3 lok. — Kölingared: Hallebo, Söre. Böne: Lönnern. Knätte: Igelsered, Köpmantorp. Liared: 6 lok. Hössna: 3 lok. Gullered: Sjögared. *Kind.* Tvärred: Tvärredslund. Dannike: Rölle. Finnekumla: Fästered, Sundet. Marbäck: 3 lok. S. Säm: Attorp, Bossgården. Gällstad: Bystad, Intorp, Lid. Grönahög: Åbjörntorp. Sexdrega: Kortö (GSn), Skogsgården. *Ås.* S. Ving: 8 lok. Varnum: Årnäs. Rångedala: Falskog. Äspered: 3 lok. Toarp: 6 lok.

C. pratensis. — Allmän.

Barbarea vulgaris. — Allmän.

B. stricta. — T. allmän.

Arabis hirsuta. — *Redväg.* Smula: åsryggarna i byn, Kolbrandstorp, L. Fagerås. N. Åsarp: 7 lok. Kölaby: 6 lok. Humla: Storegården, åsryggarna vid Ätran. Blidsberg: 7 lok. Dalum: 9 lok. Timmele: 6 lok. Vist: Vistberget. Brunn: 5 lok. Ulricehamn (Rdb). — Solberga: åsryggen S om kkn. Knätte: kkn, kullarna S om kkn. Hössna: 5 lok. Gullered: Sjögared (Ndm). *Kind.* Tvärred: Ruggebo. Länghem: stn. Finnekumla: Sundet. Marbäck: Näsboholm (ÖN). S. Säm: Vegby. *Ås.* S. Vånga: Backabo. Murum: Rya. Hällstad: Hof. S. Ving: Tångagärde. Varnum: mell. sjöarna. Rångedala: Falskog (S & S). Äspered: Hallabron, Tångagärdshage, Vatunga. Toarp: Myrås (G).

A. arenosa. — Nästan uteslutande på banvallarna. Sedd inom alla berörda socknar. Dessutom vid: *Redväg.* Hössna: nyanlagd landsväg vid Grubbäcken. *Kind.* Finnekumla: Lindevik (åker). Marbäck: Korpebo (sjöstrand). S. Säm: Ågården. Sexdrega: vägskäl N om Buttorp (Tld). *Ås.* Toarp: Gällsjön (åker), Kerstinsgärde (åker), Kråkhult (S).

Arabidopsis thaliana. — T. allmän.

Turritis glabra. — T. allmän. Sedd inom flertalet socknar.

Rorippa silvestris. — *Redväg.* Ulricehamn: stn 1920. *Kind.* Finnekumla: Sundet (G). Hillared: trädgårdsogräs vid kkn 1934 (S). *Ås.* Fänneslunda: herrgården 1925 (B).

R. islandica. — T. allmän.

Hesperis matronalis. — Odlad och förvildad.

Erysimum cheiranthoides. — Allmän.

Alliaria officinalis. — *Redväg.* Dalum: Vinsarp (Rdb).

Sisymbrium officinale. — *Redväg.* Ulricehamn: stn. *Ås.* S. Ving: Hökerum. Toarp: Skäftingsbacka.

Camelina microcarpa. — *Redväg.* Kölaby: Sverkilstorp. Timmele: åker N om samhället. — Knätte: Lunds by 1938. *Ås.* S. Ving: Aspanäs stn 1938—1948 (G), prästgården 1929.

C. alyssum. — *Redväg.* N. Åsarp: stn. Timmele: N om Lena. Brunn: Kälkared 1924. — Kölingared: Kölingsholm 1926. *Kind.* Länghem: linåker vid stn 1923. *Ås.* Möne: Rävike, Östergården. S. Ving: Säby 1921. Toarp: Dalsjöfors stn (G), Kulla (G).

Descurainia sophia. — *Redväg.* Smula: L. Fagerås. Kölaby: Trädet. Blidsberg: stn. Dalum: stn. Vist: nya sopstn. Ulricehamn: stn. — Fivlered: vägkant N om pkt 238. *Kind.* Månstad: stn. S. Åsarp: Limmareds stn. *Ås.* S. Ving: Hökerums stn. Varnum: stn. Toarp: Dalsjöfors, Toarpsdals stn.

D. brachycarpa. — *Ås.* S. Ving: Aspanäs 1 ex. 1934 (det. E. Asplund).

Sedum telephium. — Allmän.

S. spurium. — Odlad och förvildad på flertalet av bygdens kyrkogårdar. Dessutom sedd vid: *Redväg.* Timmele: Ekarp, Vång. *Kind.* Tvärred: Handvik, Hult. Finnekumla: Sjörred (klippor på sjöstranden). Marbäck: Korpebo. Grönahög: Nyarp. Hillared: bäcken vid kkn. *Ås.* Hällstad: torp S om Brunstorp, Hof. Härna: Sassarp. S. Ving: Bredaslätt, Romsås, Sjöbredared. Varnum: stn. Äspered: Hallabron, Sundholmen. Toarp: St. Bygd (S).

S. rupestre. — *Redväg.* Ulricehamn 1782.

S. album. — *Ås.* Grovare: på kullen nedom kyrkoruinen (fv.).

S. annuum. — *Redväg.* Smula: vid Ätran N om byn. N. Åsarp: 4 lok. Humla: kkn. Blidsberg: Danstorp. Dalum: 7 lok. Timmele: 4 lok. Vist: 3 lok. Brunn: 3 lok. — Kölingared: 3 lok. Knätte: Igelsered. Liared: Yttre Lida. *Kind.* Tvärred: S. Backa. Länghem: 3 lok. Finnekumla: kkn. Marbäck: 3 lok. S. Säm: Attorp, Sandslätt (Kj). Gällstad: Hjortsbacka. Månstad: kkn. *Ås.* Kärråkra: Öjelunda. S. Vånga: 3 lok. Möne: 4 lok. Murum: 6 lok. Hällstad: 12 lok. Grovare: 2 lok. Fänneslunda: kkn. Härna: 4 lok. S. Ving: 16 lok. Tärby: kkn. Varnum: 6 lok. Rångedala: 3 lok. Äspered: 3 lok. Toarp: Åsen (B, S).

S. sexangulare v. ***boloniense.*** — *Kind.* Ljushult: Arnäsholm (fv.). *Ås.* S. Ving: Torp (fv.).

S. acre. — T. allmän.

Sempervivum tectorum. — *Redväg.* Dalum: Vinsarp (»på taket av en torpstuga») (Rdb).

Crassula aquatica. — *Redväg.* Dalum: Vinsarp (Rdb).

Parnassia palustris. — T. allmän i *Redväg* o. *Ås*, sällsyntare i *Kind*, varifrån noterats: Tvärred: Alhammar, Ö om Bodarna. Dannike: Backa, Boanäs, Ramsjön. Länghem: Djurgården, Sandsjönäs. Marbäck: Källebacka, Näsboholm. S. Säm: Ramasjön. Grönahög: Vrångestorp. Ljushult (S). Hillared: Hösjön, Kärraholm, Lagsjön. Sexdrega: Björsjöberget, Björsjön, Buttorp, Sandsjönäs. Hulared: Reutersberg.

Saxifraga tridactylites. — *Redväg.* Blidsberg: Dalakvarn (grustag), S om Hallabo, moränås Ö om Holmen, kkn (brinkarna Ö om Ätran), jvgn N om stn. Dalum: Björkestorp, Krutbrännaregården (brinkarna) (G), Pålstorp, mell. Svenstorp o. Ögården (vägkant 1943). Timmele: Vång. Ulricehamn 1782. — Böne: Ingared (Hård). *Ås.* Hällstad: Hof, kkn, prästgården (TH). S. Ving: Ekeslunda (S).

S. granulata. — Allmän.

Chrysosplenium alternifolium. — Ej konsekvent antecknad i Ås. — *Redväg.* Humla: Haberget, Väddåkra. Dalum: Nöre, Plate, Vinsarp. Timmele: 7 lok. Vist: Fotåsen, Ubbared, Vistberget (TH). Brunn: 7 lok. Ulricehamn: Lindängen, stadsparken. — Fivlered: St. Loppås. Kölingared: 5 lok. Böne: Marbohemmet. Hössna: 6 lok. Gullered: Ekesbo (Ndm). *Kind.* Tvärred: 7 lok. Dannike: 3 lok. Länghem: Hovsnäs. Finnekumla: Fästered, Övrarp. Marbäck: 5 lok. S. Säm: Attorp, Klevaberget, Vegby. Grönahög: Högaberg, Åbjörntorp. Ljushult: Backa. Sexdrega: 5 lok. *Ås.* Fänneslunda: Solberga. Härna: Sassarp. S. Ving: 6 lok. Varnum: Boarp. Rångedala: Ormåsa, prästgården. Äspered: Hallabron, Vatunga. Toarp: 6 lok.

Ribes uva-crispa. — T. allmän.

R. nigrum. — T. allmän.

R. rubrum. — T. allmän.

R. alpinum. — *Kind.* Länghem: Torpa (näset 1 ex., fv.). S. Säm: Vegby (fv.). *Ås.* S. Ving: Tomta (1 ex., fv.). Toarp: Gånghester (S & S), Målsryd (S & S), Skårsdal (S).

Filipendula ulmaria. — Allmän.

F. vulgaris. — Allmän i Ätradalen N om Ulricehamn. *Redväg.* Solberga: kkn. Kölingared: 3 lok. Böne: 4 lok. Knätte: 3 lok. Liared: 3 lok. Hössna: 6 lok. Gullered: kkn, Sjögared (Ndm). *Kind.* Tvärred: Rude, Tvärredslund. Länghem: Kinnaliden, Torpa. Marbäck: byn, Storegården. S. Säm: 3 lok. Gällstad: Hjortsbacka, Intorp. Hillared: 4 lok. Sexdrega: 6 lok. Månstad: kkn. Dalstorp: Boarp. Hulared: kkn. *Ås.* Kärråkra: kkn, Sjö. Möne: Givarp, kkn, Sjöarp. Murum: kkn, Skålarp. Hällstad: 10 lok. Grovare: Ulvared. Fänneslunda: Gälabo, Karstorp. Härna: 4 lok. S. Ving: 13 lok. Varnum: 7 lok. Rångedala: 5 lok. Äspered: Vatunga. Toarp: 4 lok.

Prunus avium. — T. allmän. Subspontan. Mest yngre individ.

P. padus. — Allmän.

Rubus chamaemorus. — T. allmän.

R. saxatilis. — T. allmän.

R. idaeus. — Allmän.

R. nessensis. — *Redväg.* Dalum: SV om Silarp. Timmele: Platekvarn. Brunn: S om L. Ekered, Snipe. Vist: Härstorp. Ulricehamn (Rdb). *Kind.* Tvärred: 10 lok. Dannike: Lärjered. Marbäck: Sjö-Gunnarsbo. Gällstad: Götåkra (Kj). Ljushult: 4 lok. Sexdrega: Kortö (GSn). Dalstorp: Gundlabo (Kj). *Ås.* Hällstad: Hallebo, Väby. Grovare: Sjögården. S. Ving: 6 lok. Varnum: Marsjön (Kj). Rångedala: Gravryd, N om Klämmestorp, Ormåsa. Äspered: kyrkbyn. Toarp: 5 lok.

R. caesius. — *Ås.* Hällstad: S om Pjukarp (vägkant).

Fragaria vesca. — Allmän.

F. viridis. — *Redväg.* Smula: åsarna S om byn, Kolbrandstorp, moränkulle S om kyrkoruinen, L. Fagerås, moränås S om L. Fagerås, vid bron över Skråern. N. Åsarp: Alvared, Ekeberga, Frugården, Hög (S), heden S om kkn, N om kkn, Långekra, Skägga, Åsarp Rättaregården, N om Åsen. Kölaby: Borred, Danstorp, kkn, Rynninge, Sverkilstorp, Tummarp. Humla: kkn, vägkant N om kkn, Södertorpet. Blidsberg: Björn-

arp (vid landsvägen), Brolyckan, Dalakvarn, kkn, Kässeberg (baktrågen). Dalum: Krutbrännaregården, Nöresjön, Plate, Silarpskullen, Svenstorp, Vång, Ögården. Timmele: Nöre (brinkarna). — Solberga: kkn. Knätte: kkn, moränkullarna 500 m S om kkn (S). *Kind.* Marbäck: Storegården (moränås vid idrottsplatsen). *Ås.* S. Ving: Röstekärr (1 ex. vid jvgn). Varnum: Bossgården (tillsammans med *Dracocephalum*). — Karta (fig. 3).

F. moschata. — Understundom förvildad. *Redväg.* N. Åsarp: prästgårdskärret. — Strängsered: stn. *Kind.* Tvärred: Tvärredslund. Länghem: Torpa. S. Säm: Attorp. Hillared: Veka. *Ås.* Grovare: Sjögården. S. Ving: Aspanäs (jvgn), Bredaslätt. Toarp: Andared, 300 m N om kkn, Starhester.

Potentilla palustris. — Allmän.

P. rupestris. — *Redväg.* Smula: getryggen S om byn, Kolbrandstorp, L. Fagerås, moränkulle vid bron över Skråern. N. Åsarp: Alvared, Brunnsgården, Ekeberga, Frugården, Hansagården, gärdet N om kkn, heden S om kkn, Långekra, Skägga, Slättåkra, stn, Ågården, Åsarp Rättaregården, N om Åsen. Kölaby: Borred, Danstorp, Rynninge, Sverkilstorp, Trädet (Pehr Hasselrot), Tummarp, S om Tåstarp. Humla: Drättekvarn, Hulegården, NO om kkn, åsryggar på gränsen till Kölaby, åsrygg vid Ätran. Blidsberg: Björnarp, Brolyckan, Dalakvarn, Danstorp, Deragården, N om folkskolan, S om Hallabo, mell. Hallabo o. Holmen, Kässeberg (baktrågen), Ö om vägen som från stn leder norrut (S). Dalum: allmän i Ätradalen. Timmele: Knuve, Kroken (ÖN!), 1 km N om kkn, Källeberg, Nöre, Vång. Vist: Vistberget o. i stupet 500 m S om detsamma. Ulricehamn (S) (Rdb). — Solberga: kkn samt åsarna N o. S om densamma. Kölingared: Valshalla. Knätte: kkn, kullarna 500 m S om kkn. Hössna: Holmarp, Hössnatorp, Kinnared, Krokstorp, moränbackarna vid kkn o. prästgården, skjutbanan, Torpet, Valared. *Ås.* Hällstad: Hof. Rångedala: Dränggården (G), Kristinelund 1866 (S) (sannolikt = föreg. lok.). Toarp (1880-talet).

P. argentea. — T. allmän.

P. recta. — *Redväg.* Dalum: Vinsarp (S). *Ås.* Härna: prästgården.

P. norvegica. — *Redväg.* N. Åsarp: Valundasjön. Dalum: Silarp, Vinsarp. Timmele: Bjättlunda, Kattåkra, Röstesjön 1925, Sjöbacka. Vist: kkn. Brunn: villastaden (ÖN). Ulricehamn: badplatsen 1948. — Fivlered: byn 1949, Årred. Böne: Gamlegården, Lönnarp, Marbohemmet, Åfärd. Knätte: kkn, Lund 1938. Hössna: mossen Ö om kkn 1927, Valared. Gullered: Sjögared (Ndm). Strängsered: gästgivaregården (Ndm). *Kind.* Länghem: Hovsnäs (Kj), stn, mell. stn o. Haldarp (G). Gällstad: Frölunda. Grönahög: Åbjörntorp. Hillared: stn, Torsered 1953. Sexdrega: Hagalundsjön, Kortö (GSn). S. Åsarp: Lillån vid Skårtebo, Limmareds stn. *Ås.* Murum: Årred. S. Ving: 12 lok. Varnum: mell. sjöarna, stn, Ågården. Rångedala: Finnekumla, Klämmestorp, Ormåsa. Toarp: Draskamad (G), L. Bygd (G).

P. intermedia. — *Redväg.* Vist: jvgn N om kkn 1931. *Kind.* S. Säm: Vegby vid Sämsjön 1921 (G, S). *Ås.* S. Ving: Hökerum (vid bron över Viskan 1945).

P. thuringiaca. — *Ås.* Äspered: Vatunga 1942. Toarp: Häljared (vägkant).

P. Crantzii. — Allmän i Ätradalen N om Åsunden. *Redväg.* Solberga: getryggen S om kkn. Kölingared: 7 lok. Böne: Hällunda, N om kkn. Knätte: 5 lok. Liared: 4 lok. Hössna: 13 lok. Gullered. *Kind.* Tvärred: Rude, Tvärredslund. Länghem: Torpa. Finnekumla: mell. Fästered o. Sjörred. Marbäck: 6 lok. S. Säm: Bossgården. Gällstad: Hjortsbacka. Ljushult: Ö om Hjortadalen, Kovra. S. Åsarp: Ladugården (UB). *Ås.* Möne: 4 lok. Hällstad: 7 lok. Grovare: kkn, Ulvared. Fänneslunda: Boarp, herrgården, Kullatorp. Härna: Angsjön, Tissås, Åstorp. S. Ving: 20 lok. Varnum: 10 lok. Rångedala: Byttorp (G), Dränggården, Finnekumla, Hagen, Klockaregården. Äspered: Vatunga. Toarp: Bygd (G), kkn.

P. Tabernaemontani. — *Redväg.* Smula: åsryggarna kring byn, kkn, L. Fagerås. N. Åsarp: 10 lok. Kölaby: 7 lok. Humla: Drättekvarn, Haberget, åsryggar vid kkn, åsrygg vid Ätran NO om kkn, Nickabo. Blidsberg: 9 lok. Dalum: 8 lok. Timmele: 6 lok. Vist: Prången (ÖN), NV om Rydet, Vistafors. Ulricehamn (G, S). — Solberga: på moränåsen genom socknen. Kölingared (Kj). *Kind.* Marbäck: S om kkn, Storegården. *Ås.* Kärråkra: Sjö. S. Ving: landsvägskant mell. Dållebo o. Trogared (B). Varnum: Dållebo (B), Nitta (Kj). Rångedala: Buttorp 1910 (G, S).

P. erecta. — Allmän.

P. anserina. — T. allmän.

Agrimonia odorata. — *Redväg.* Brunn: »bergen vid Åsunden» (Hård). Ulricehamn (id.: uppg. av S. M. Kjöllerström). *Kind.* Tvärred (id.). — Arten har ej kunnat återfinnas inom någon av de uppgivna socknarna.

A. eupatoria. — *Redväg.* Ulricehamn (Rdb). — Gullered: vägkant mell. byn o. Ekesbo. *Ås.* Hällstad: Hof.

Sorbus intermedia. — Spridd i enstaka individ över hela området. Subspontan.

S. aucuparia. — Allmän.

[*Crataegus oxyacantha.* — Saknas helt. Uppgifterna hos Westfeldt 1926 avse *C. calycina.*]

C. calycina (*curvisepala*). — *Redväg.* Smula: vid bron över Skråern. Humla: åsryggar vid Ätran NO om kkn. Blidsberg: Deragården, Hallabo (även rödblommig), kkn (Ö om bron), St. Börsbo. Dalum: Svenstorp, Vång. Timmele: Frälsegården, Knuve, sluttningen V om samhället. Vist: Hössnavägen, Vistberget. Brunn: Hede, Kråkebo, Kråkeboberg, Remma, St. Ekered, Tranegärde, Åsakullen. Ulricehamn: Lindängen. — Kölingared: Årås. *Kind.* Tvärred: Hjärtsbo, Hulud, Skog, N om Tvärredslund. Dannike: Rölle, Slätten. Länghem: Hovsnäs. Finnekumla: NO om herrgården (1 ex., fv. ?). Marbäck: Kärrabo. S. Säm: Attorp, Klevaberget. Ljushult: Backa. Sexdrega: Högen (S), Lysjön (B, S). *Ås.* S. Ving: 12 lok. Varnum: Boarp. Äspered: Sundholmen, Vatunga. Toarp: Drared, Skäftingsbacka, St. Bygd (S).

[*C. monogyna.* — *Redväg.* Ulricehamn (Rdb). — Avser säkerligen *C. calycina.* I Riksmuseets samlingar ligga en del *Crataegus*-ark, insamlade av

A. O. Olson. Då de efter allt att döma avse odlade individ, ha de utelämnats.]

Malus silvestris. — T. allmän.

Amelanchier spicata. — *Redväg.* Timmele: vägkant vid folkskolan. Vist: 1 km N om kkn. *Kind.* Finnekumla: Sjörred. *Ås.* Äspered: Hallabron 1 ex. Toarp: Kronäng.

Cotoneaster integerrimus. — *Redväg.* Kölaby: Danstorp (moränås), S om Tummarp (moränås). Vist: Vistberget. Brunn: Kråkeboberg. *Kind.* Tvärred: Alhammar (bergsstup). *Ås.* Varnum: Kvarnagården (moränås) (G).

Geum urbanum. — T. allmän.

G. rivale. — Allmän.

G. rivale* × *urbanum. — *Redväg.* Timmele: Nygården. Brunn: Kälkared. — Kölingared: Åråsen (Kj). *Kind.* Tvärred: Hult, Tvärredslund. Dannike: Rölle. Marbäck: Källebacka. S. Säm: Attorp, Klevaberget. Hillared: Gälared. Sexdrega: Kortö (GSn). *Ås.* Murum (TH). S. Ving: Hökerum. Äspered: Vatunga. Toarp: Bygd (G), Lindås (G), Skår (G).

Sarothamnus scoparius. — *Kind.* Hillared: Hinnared (fv.).

Ononis arvensis. — *Ås.* Hällstad: Hof (S).

Medicago lupulina. — *Redväg.* Smula: moränkullen vid bron över Skråern, åsarna. N. Åsarp: kkn, Åsen. Kölaby: Gärdet. Blidsberg: ullspinneriet. Ulricehamn: stn. — Hössna: prästgården. *Kind.* Länghem: Torpa. Sexdrega: Långsjön (i åker). *Ås.* På kyrkogårdarna i Kärråkra, Möne, Hällstad, Härna, Varnum o. Äspered. Härna: prästgården. S. Ving: Aspanäs (i åker), Hökerums stn. Äspered: Hallabron, Vatunga.

M. sativa. — Odlad o. förvildad. *Redväg.* Dalum: Plate. *Kind.* Dalstorp: Boarp. *Ås.* S. Ving: Torp (vägkant, insådd). Toarp: Gånghester (vägkant, insådd).

Melilotus albus. — *Redväg.* N. Åsarp: samhället 1945. *Ås.* Härna: prästgården 1925.

Trifolium dubium. — *Redväg.* Blidsberg: jvgn N om stn. Ulricehamn: sjukstugan 1948. — Gullered: Ubbareds by 1944. *Kind.* Länghem: stn 1927. *Ås.* Äspered: Hägnagärde. Toarp: Målsryds stn 1909 (G).

T. campestre. — *Redväg.* Kölaby: Stommen. Vist: nya sopstn. Ulricehamn: badplatsen. *Ås.* S. Ving: Aspanäs, Björnared 1945.

T. aureum. — *Redväg.* Blidsberg: vägkant S om kkn. Dalum: Ätran vid Krutbrännaregården, Nöresjön, jvgn N om Plate, Pålstorp, Ögården. Timmele: Nöre. Brunn: Brunnsnäs hpl., Åsakullen 1935 o. 1949. Ulricehamn 1839 (S). — Hössna: byn (Ndm). Gullered: Ekesbo (id.). *Kind.* Marbäck: Storegården (H. Helmrot). Hulared: Stålared 1945. *Ås.* Hällstad: NO om kkn (S). Fänneslunda: herrgården. S. Ving: Björnkällan 1924, Säby. Varnum: grustaget N om stn 1923. Äspered: Vatunga 1949. Toarp: St. Bygd (G).

T. spadiceum. — *Kind.* Tvärred: Fagerberg (vägkant, 4 ex. 1944).

Sexdrega: Segerstad 1954 (Tld). *Ås.* Varnum: stn. Toarp: St. Bygd 1921 (G), Tjärnsjö (G).

T. hybridum. — Allmän.

T. repens. — Allmän.

T. montanum. — *Redväg.* Smula: L. Fageräs. N. Åsarp: Alvared, Långekra, Åsarp Rättaregården. Kölaby: Frugården. Blidsberg: moränkulle nedom Svenstorp. Dalum: brinkarna vid Krutbrännaregården, N om kyrkbron, vid småsjöarna 500 m S om kkn, Plate, Pålstorp, Silarpskullen, Ögården, Öv. Vång (Rdb). Timmele: Nöre. — Karta (fig. 2).

T. arvense. — *Redväg.* Humla: åsrygg NO om kkn, Smedsgården. Blidsberg: kkn (brinkarna Ö om ån). Dalum: Krutbrännaregården, kkn, Silarpskullen. Timmele: Nöre, stn. Vist: Ubbarp. Brunn: Kråkeboberg. — Fivlered: kkn. Hössna: Hössnatorp, prästgården, Åkerby. Gullered: kkn. *Kind.* Tvärred: Tvärredslund. Marbäck: kkn. Sexdrega: Buttorp, stn. *Ås.* Kärråkra: kkn, Ryagärde, Sjö. Möne: kkn, Rävike. Hällstad: Gammalstorp, Hof, Katthög, kkn, Tågården (TH). Grovare: Hökaberg. S. Ving: Aspanäs, Nygården, Romsås, Tolkabro. Varnum: Boarp, mell. sjöarna. Rångedala: Bredared, Dränggården, Klämmestorp. Toarp: kkn.

T. pratense. — Allmän.

T. medium. — T. allmän.

Anthyllis vulneraria. — Allmän i Ätradalen N om Timmele. Eljest spridda förekomster. *Redväg.* Vist: jvgn, kyrkbron. Brunn: stn. Ulricehamn: stn. — Solberga: Baggekvarn, kkn, getryggen S om kkn. Kölingared: Ingared. Knätte: kullarna 500 m S om kkn. Liared: Holmåkra, åsen vid kkn. Hössna: Torpet, Åsen (Ndm). Gullered: kkn (id.), Sjögared (id.). *Kind.* Dannike: Rölle. Länghem: Torpa (näset). Marbäck: SV om kkn, Storegården (moränås). Ljushult: Aplared (jvgn). Hillared: Hultet, kkn, stn. Sexdrega: Bränningen, stn. S. Åsarp: Limmareds stn. *Ås.* Kärråkra: kkn, Sjö. Möne: Bolstorp, kkn. Murum: Kyrkeberg. Hällstad: Brunstorp, Gammalstorp, kkn. Fänneslunda: Karstorp. S. Ving: Ekeslunda, Fäbroarna, Högryd, Tomta. Tärby: kkn. Varnum: Kvarnagården, mell. sjöarna. Rångedala: Dränggården, Falskog (jvgn). Äspered: Tångagårdshage. Toarp: Balterna (G), Tokarpsskogen (G). Sprider sig utmed landsvägarna.

Lotus corniculatus. — Allmän.

L. uliginosus. — *Redväg.* Brunn: Redvägsbrunn (jvgsdike). *Ås.* Toarp: St. Bygd (G).

Astragalus glycyphyllus. — *Redväg.* N. Åsarp: Ekeberga. Humla: åsrygg vid Ätran NO om kkn, Smedsgården. Blidsberg: Kässeberg (baktrågen). Dalum: Svenstorp (moränkulle vid Ätran), Vång. Timmele: Kattåkra, Knuve. Vist: Fotåsen (ÖN). Brunn: Kråkeboberg, Åsakullen. Ulricehamn 1782. *Kind.* Marbäck: Sjö-Gunnarsbo (G). S. Säm: Klevaberget. S. Åsarp: Oppensten. *Ås.* Hällstad: Sandslätt (S). Härna: Björnsgården (V om Anksjön). S. Ving: Hökerum. Varnum: Boarp.

Ornithopus sativus. — *Redväg.* Ulricehamn (G). *Ås.* S. Ving: Hökerums stn 1925.

Vicia hirsuta. — *Redväg.* Timmele: Bjättlunda, Bredsjön, stn.

Brunn: Brämmesås, Skogen, Snipe. Ulricehamn: stn. — Böne: Marbohemmet. Knätte: kvarnen. Gullered: Karlabo. *Kind.* Länghem: prästgården. S. Säm: Svedjorna. Ljushult: Aplareds stn (G). *Ås.* S. Vånga: Backabo. Hällstad: 6 lok. Grovare: Ulvared, Väddingslätt. Härna: Sassarp, Östergården. S. Ving: 10 lok. Rångedala: Holmen, stn, Vevelhult. Äspered: kyrkbyn, Sundholmen, Vatunga.

V. tetrasperma. — *Redväg.* Dalum: Vedåsa. Vist: Vistberget. Brunn: vid jvgn. Ulricehamn: stn. — Strängsered: Kimmarebo. *Kind.* Marbäck: Storegården. S. Säm: Vegby. *Ås.* S. Vånga: Backabo. Hällstad: Hof, kkn. S. Ving: Aspanäs, vid Röstesjön. Toarp: Toarpsdals stn.

V. silvatica. — *Redväg.* Kölaby: Örsered vid Yttern (Bgt). Blidsberg: Kässeberg (baktrågen). Timmele: Knuve, Källeberg. Brunn: Kråkeboberg (G), Åsakullen (G). Ulricehamn 1782. *Kind.* Länghem: SV om Gäddviken (GSn). Grönahög: Torsberg.

V. cracca. — Allmän.

V. villosa. — *Redväg.* Blidsberg: Deragården. Dalum: Krutbrännaregården. Timmele: Bjättlunda, Kattåkra, kkn. Vist: Hester, kkn. Brunn: Snipe (ÖN). — Knätte: kkn. Hössna: prästgården, Valared. *Kind.* Tvärred: Högagärde. Länghem: Haldarp. Gällstad: Bystadsjön (Kj). Hillared: Mölnered 1946. *Ås.* S. Vånga: Backabo 1926. Möne: Rävike, Östergården. Hällstad: prästgården, Tågården 1933 (TH), Väby 1929, Älmestad. S. Ving: Aspanäs, prästgården, Svederna. Toarp: Målsryd 1910 (G, S), Slätthult (G, S).

V. sepium. — Allmän.

V. angustifolia. — T. allmän.

V. pannonica ssp. ***striata.*** — *Redväg.* Dalum: Vinsarp 1952 (G).

Lathyrus silvestris. — *Kind.* Marbäck: Sjö-Gunnarsbo (G). S. Åsarp: Oppensten (B, G).

L. heterophyllus. — *Redväg.* N. Åsarp: Bredsundskvarn 1883 (U), gärdet N om kkn, Skägga (moränkulle), stn, Åsarp Rättaregården. Kölaby: Danstorp. Humla: Hulegården (Ö om vägen). Blidsberg: Björnarp, Brolyckan, Dalakvarn, Deragården, mell. Hallabo o. Holmen, bron vid kkn, Kässeberg, moränkulle vid Ätran på gränsen till Dalum. Dalum: brinkarna vid Ätran S om kyrkbron (L), Plate, Rom, Svenstorp (moränkulle vid Ätran), Vinsarp, invid Vinsarpsmossen, Vång, Ögården. Timmele: Kattåkra. Vist: Ubbarp. Brunn: Hede, Remma. Ulricehamn (L) (Rdb). — Solberga: getryggen nära kkn. Kölingared: Kölingsholm (S). Böne: N om kkn, Marbohemmet, Ö om prästgården. Knätte: kullarna 500 m S om kkn. Hössna: Hössnatorp, prästgården, vid källaren 500 m N om prästgården (även vitblommig) (G, L). Gullered: bygärdet (Ndm), Frälsegården (B), N om kkn. *Kind.* Marbäck: S om kkn, Storegården (grustag i moränås) (G). S. Säm: Vegby (ÖN!). *Ås.* Hällstad: Brunstorp, Hof (S). Härna: vid Grundsjön, Habo. S. Ving: Hökerum, Nollyckan (Säby kronopark) (G, L, S), Nygården (G), Romsås. Toarp: St. Bygd 1906 (G, U) (sannolikt odl. i Toarp).

L. pratensis. — T. allmän.

L. palustris. — *Redväg.* Dalum: N om stn (jvgsdike) (A. Stalin, B,

S), Vinsarp (mosskanten S om gården), Vinsarpsmossen. — Böne: prästgården (Ndm) (avser antagl. samma lokal som Dalum: Vinsarpsmossen). Gullered: Skattegården. *Kind.* Hillared: Påtebo (vid Ätran) (G). *Ås.* Varnum: N om stn (sankmarker vid Viskan).

L. montanus. — Allmän.

L. niger. — *Redväg.* Timmele: Kattåkra, Knuve. Brunn: Kråkeboberg (G), V om Snipe, Åsakullen. Ulricehamn (Rdb). *Kind.* S. Säm: Klevaberget.

L. vernus. — *Redväg.* Brunn: Kråkeboberg, Remma, Åsakullen. — Kölingared: Valshalla (G). Liared: Tuskan (Ndm). *Kind.* Dannike: Rölle (G). Länghem: mell. Hovsnäs o. Torpa. Marbäck: Korpeboberg. S. Säm: Klevaberget. Grönahög: Högaberg (Kvl!). *Ås.* S. Ving: Senered. Rångedala (Kj). Äspered: »på gränsen till Dannike vid Rölle 1906» (A. O. Olson).

Oxalis acetosella. — Allmän.

Geranium sanguineum. — *Redväg.* Smula: åsryggarna genom byn, Kolbrandstorp, L. Fagerås, bron över Skråern. N. Åsarp: allmän på åsryggar o. moränkullar. Kölaby: 8 lok. Humla: 5 lok. Blidsberg: 7 lok. Dalum: allmän i Ätradalen. Timmele: Bjättlunda, Brostorp, Ekarp, Nöre, Vång. Vist: Ubbarp, Vistberget. Brunn: Kråkebo, Kråkeboberg, Torpet, Åsakullen. Ulricehamn (Rdb). — Solberga: N om kkn. Kölingared: Baggekulla, Kölingsholm. Böne: Hällunda, NO om kkn, Marbohemmet. Knätte: kullarna 500 m S om kkn, Långsered. Liared: korsvägen N om kkn. Hössna: 7 lok. Gullered: S om kkn. *Kind.* Tvärred: Tvärredslund. Finnekumla: N om herrgården (ÖN). Marbäck: Storegården (moränås vid idrottsplatsen). S. Säm: Attorp, vid telegrafstn, Vegby. Gällstad: Berga (G). Ljushult: ovan Sandsjön (A. O. Olson). Hillared: Påtebo. Sexdrega: Kortö (GSn), Tjuvakulle (Hpn). *Ås.* Kärråkra: moränåsen vid kkn, Ryagärde. S. Vånga: Backabo, Jonstorp. Möne: kkn, Rävike, Sjöarp. Hällstad: 8 lok. Grovare: Avelsås. Fänneslunda: Karstorp, Kullatorp. Härna: byn, sluttningen mot Gärdsjön, Tissås, Östergården. S. Ving: 9 lok. Tärby: Segerstorp. Varnum: Bossgården, Skabo, stn, Tångabol. Rångedala: Hagen. Toarp: kkn.

G. columbinum. — *Ås.* S. Ving: Romsås.

G. dissectum. — *Ås.* Äspered: Lövaskog, torpet Skogen V om kkn (G).

G. silvaticum. — Allmän.

G. pratense. — *Redväg.* Dalum: Vinsarp. Timmele: banvaktsstugan, Vång. — Fivlered: Ramsberg. Böne: Hällunda. Liared: kkn. *Ås.* Hällstad: Kärragärde, prästgården (TH), Väby (S). S. Ving: Linnet. Toarp: Målsryd (S), Taryd.

[*G. phaeum.* — *Ås.* Toarp: St. Bygd (fv.) (G).]

G. pyrenaicum. — *Kind.* Sexdrega: prästgården (Hpn).

G. molle. — *Redväg.* Blidsberg: kyrkbron. Ulricehamn: folkskolan (ÖN). — Gullered: Ekesbo (Ndm). *Ås.* Varnum: stn.

G. pusillum. — *Redväg.* Blidsberg: Brolyckan. Dalum: Vång. Vist: Prången (ÖN). Brunn: Brunnsnäs (ÖN). Ulricehamn. — Solberga: kkn. Liared: Backgården (Ndm). *Kind.* Länghem: Haldarp, stn. Mar-

bäck: kkn. Sexdrega: Buttorp. S. Åsarp: Åsarps by. *Ås.* Hällstad: Hof. Grovare: Högagärde. Härna: kkn, prästgården. S. Ving: Aspanäs, Tolkabro. Äspered: Vatunga. Toarp: kkn.

G. lucidum. — *Redväg.* Dalum: Vinsarp (Rdb). Brunn: Ekered 1874 (G), Kråkeboberg. Ulricehamn: bergen (Rdb). Ekered o. Kråkeboberg avse sannolikt samma lokal. — Se vidare Westfeldt 1947.

G. robertianum. — T. allmän.

Erodium cicutarium. — T. allmän.

Radiola linoides. — *Redväg.* Brunn: Brunnsnäs. Ulricehamn 1782. — Gullered: Sjögared (Ndm). *Kind.* Länghem: Gärdsjön (G). Dalstorp: sjön vid kkn (G). *Ås.* S. Ving: Angsjön, Mogden (S). Tärby, Varnum o. Rångedala: vid Finnekumlasjön o. Marsjön.

Linum catharticum. — *Redväg.* Smula: 3 lok. N. Åsarp: 9 lok. Kölaby: 5 lok. Humla: Väddåkra, moränkullarna V om Ätran. Blidsberg: 6 lok. Dalum: 7 lok. Timmele: 5 lok. Brunn: 5 lok. Ulricehamn: Lindängen. — Solberga: Baggekvarn, getryggen vid kkn. Kölingared: Ingared, Lönnern. Böne: 4 lok. Knätte: 3 lok. Liared: N om kkn, Ubbholmen. Hössna: 4 lok. Gullered: Bäcken, SV om Nolsjön. Strängsered (Kj). *Kind.* Tvärred: Rude (Kj). Länghem: Angsjön, Djurgården. Marbäck: Åsunden vid Korpebo. S. Säm: Ramasjön. *Ås.* Kärråkra: kkn. Möne: Bolstorp, Rävike, Östergården. Murum: Aplaberg, Skålarp, Årred. Hällstad: 9 lok. Grovare: Bränning. Fänneslunda: sjön. S. Ving: 12 lok. Tärby: Finnekumlasjön, Öna. Varnum: Käringsjön, stn. Varnumssjöarna. Rångedala: Gretlanda, S om Mellsjön. Äspered: Gullestorp (G), Vatunga. Toarp: Germundared (G).

Polygala vulgaris. — Allmän.

P. amarella. — *Redväg.* Smula: L. Fagerås, bron över Skråern. N. Åsarp: Alvared, fuktäng N om kkn, stn, Valunda (G). Kölaby: Borred, S om Borred mot Humla, missionshuset (Bgt), Stommen, Sverkilstorp, Trädets gård, Tummarp. Humla: Haberget, grusgrop vid gränsen till Kölaby. Blidsberg: Björnarp, Dalakvarn, Hallabo, Påarp. Dalum: Krutbrännaregården, 500 m N om kyrkbron, dalgången mell. kkn o. Vinsarp, Plate, Silarp, stn, Vedåsa, Viesjön, Vinsarp, Vinsarpsjön. Timmele: Annestorp, Bredsjön, Kroksjöarna, Källeberg, Lena, Mölnarp, Nilsagården, Nöre (brinkarna), Vång. Brunn: Hede, Snipe, Torpet. — Kölingared: Hallebo, Marbohemmet. Böne: Björkås, vid Lönnern, prästgården, Åfärd. Knätte: vid Lönnern. Hössna: Krokstorp, mossen Ö om kkn, Torpet (UB). *Ås.* Kärråkra: kkn. S. Vånga: vägen Murum—Vånga. Möne: Bolstorp, kkn, mossen S om kkn, Rävike, Tomten, Viesjön (TH). Hällstad: Brunstorp, Gammalstorp, Hagahult, Hof, Igelsjön, Kronogården, S om kkn, Kärrängsås, L. Björken, Påvagården, Åsen (TH); allmän i dalen mell. Brunstorp o. Älmestad. Fänneslunda: sjön. Härna: mell. Bondarp o. Björken (Claes Grill). S. Ving: Angsjön, Mogden, Nitta. — Karta (fig. 4).

Euphorbia esula. — *Redväg.* Smula: L. Fagerås. *Ås.* S. Ving: Fäbroarna 1922. Toarp: Målsryd 1919 (G).

E. cyparissias. — *Redväg.* N. Åsarp: Ekeberga. Kölaby: Lundby. Dalum: Ambjörnarp. Timmele: Annestorp, Bjättlunda, Vång. — Sol-

berga: Baggekvarn, korsvägen S om kkn. Hössna: Hägnens skog (Ndm). *Kind.* Hillared: Veka. Sexdrega: ödegården vid Aspelund (GSn). Dalstorp: vid Dalstorpssjön N om kkn. S. Åsarp: Ladugården. *Ås.* Murum (TH). Hällstad: Gammalstorp. S. Ving: Bredaslätt, Nollyckan, Skogsbol. Toarp: Dalsjöfors stn, kkn, Tubbared.

E. peplus. — *Redväg.* Vist: nya sopstn. Brunn: villastaden. Ulricehamn: samskolan (ÖN). *Kind.* Sexdrega: Målek. *Ås.* Äspered: Vatunga.

E. helioscopia. — T. allmän.

Mercurialis perennis. — *Redväg.* Timmele: Frännarp, Lena, Redvägsborg. Brunn: Brämmesås, Gäla, Kråkeboberg, Kälkared, L. Ekered, Långsered, Remma, Röstesjön (utmed ett grävt dike i mossmark), Torpet, Tranegärde, Törestorp. Ulricehamn 1782. — Kölingared: Baggekulla. Böne: Björkås, Lönnarp (Hård). Hössna: Lönnåsen (N. Gustafsson). *Kind.* Tvärred: Alhammar, Hjärtsbo, Hult, Högagärde, Rude, Tvärredslund. Dannike: Rölle, Slätten. Finnekumla: Fästered, Sjörred, Sundet, Ängsön. Marbäck: Skottek. S. Säm: Attorp, Klevaberget, Vegby, torpet Viken. *Ås.* Möne: Bolstorp. Murum: Skålarp. S. Ving: 21 lok. Varnum: Boarp, Kvarnagården, Ågården. Rångedala: bäcken Algutstorp—jvgn, Byttorp, Finnekumla, Gravryd, Hagen, Klockaregården, S om stn. Äspered: Gullestorp, Hägnagärde, Lövaskog, Sundholmen, Sägryd, Vatunga. Toarp: Berget, Bråthult (G, S), Gånghester, Kerstinsgärde, Målsryd, Ramna (G, S), Senåsa, Sjögården, Skenstad, Skår (G, S).

Callitriche. — Noteringarna alltför fragmentariska, varför släktet utelämnats, jfr sid. 684.

Acer platanoides. — Antecknad från många lokaler, men som regel är det svårt att avgöra, om det gäller spontana förekomster eller ej. Säkerligen ursprunglig vid: *Redväg.* Blidsberg: Kässeberg (baktrågen). Dalum: Vång. Timmele: Knuve. Vist: Vistberget. Brunn: Kråkeboberg, Kälkared, Åsakullen, längs Åsunden på gränsen mot Tvärred. — Kölingared: Valshalla. Strängsered: Kimmarebo. *Kind.* Tvärred: Alhammar. Dannike: Rölle. Länghem: Torpa. Finnekumla: Fästered. Marbäck: Korpeboberg, Sjö-Gunnarsbo. S. Säm: Klevaberget. Grönahög: Åbjörntorp. Ljushult: Backa. *Ås.* S. Ving: Senered, utmed Tolken. Varnum: Boarp. Rångedala: Gravryd. Äspered: Sundholmen, Vatunga.

Impatiens noli-tangere. — *Redväg.* Vist: Fotåsen, Vistberget. Brunn: Kråkeboberg, Remma. Ulricehamn: Lindängen, S om stadsparken, bäck vid Åsundens trikåfabrik. — Kölingared: Valshalla. *Kind.* Tvärred: Alhammar, Högagärde. Dannike: Slätten. Länghem: Kinnaliden. Finnekumla: Fästered. Marbäck: Korpebo, Källebacka, Kärrebo, Skottek. S. Säm: Attorp, Klevaberget. Gällstad: St. Bystad. Ljushult: vid Såken (Claes Grill). Hillared: Tåstaberget vid Såken (Hpn). *Ås.* S. Ving: Bredaslätt, Hästhagen, Trogared, Tångagärde, Töve. Varnum: Kvarnagården. Äspered: Dalshester, Gullestorp, Sundholmen. Toarp: Lindås (G).

I. parviflora. — *Ås.* Rångedala: Bredared 1953.

I. Roylei. — *Redväg.* Brunn: Åsakullen (vid Åsunden). Vist: Karlslätt, nya sopstn 1953. *Kind.* Tvärred: Alhammar 1952, Högagärde. Finnekumla: Sundet.

Rhamnus catharticus. — *Redväg.* Kölaby: Tåstarp (vid bäcken). Humla: åsryggarna vid Ätran. Blidsberg: Björnarp, Brolyckan, Hallabo, Holmen, kkn, Kässeberg (baktrågen). Dalum: Flate, Krutbrännaregården, Plate, Silarpskullen, Svenstorp, Vinsarpsmossen, Vång. Timmele: Alarp, Bjättlunda, Ekarp, Kroken, Källeberg, Lena, Sjöbacka, Vång. Vist: Fotåsen, Nyboholm, Ubbarp, Vistberget. Brunn: Kråkebo, Kråkeboberg, Kälkared, Kättsered, Remma. Ulricehamn (Rdb). — Solberga: Baggekvarn, 1,5 km N om kkn. Fivlered: kkn, Ramsberg. Kölingared: Ingared, Kölingsholm, ön i Lönnern, Årås. Böne: hagmark S om Vinsarpsmossen. Knätte: Köpmantorp. Liared: Nolsjön, Oset. Hössna: mell. Brunsered o. Önnarp, Hössnatorp (UB), Krokstorp, Sjörred, Önnarp. *Kind.* Tvärred: Högagärde, Rude, Ruggebo, Tvärredslund. Länghem: Torpa. Finnekumla: Fästered, Sundet, Ängsön. Marbäck: vid bäcken genom byn, Sjö-Gunnarsbo, pkt 196,4. S. Säm: Klevaberget, Sjöbo. Gällstad: Intorp. S. Åsarp: Oppensten. *Ås.* S. Vånga: Rosendal. Möne: Bolstorp. Hällstad: Brunstorp (S), Hof, sluttningen S om kkn. S. Ving: Björnkällan, Bredsjön, Getared, Håkabo, Hästhagen, Hästskoslätt, Hökerum, Nitta, Nygården, Romsås, Sjöbredared, Skogsbol, Säby, Tångagärde, Töve, Vätersholm. Varnum: Boarp, Bossgården, Kvarnagården. Rångedala: Algutstorp, vid bäcken nedom Algutstorp, Gravryd, Hagen, Klockaregården. Äspered: Lerbäck, Sundholmen (S), Vatunga. Toarp: Långhults gärde 1895 (G), Målsryd 1918 (G), Taryd (Ldg).

Rh. frangula. — Allmän.

Tilia cordata. — Företrädesvis i socknarna kring Åsunden o. Tolken. *Redväg.* Timmele: Ekarp, Gryteskog, Knuve. Vist: Vistberget. Brunn: Brämmesås, Kråkeboberg, Kälkared, L. Ekered, Remma, Åsakullen. Ulricehamn. — Kölingared: Valshalla. Hössna: mell. Grubbäcken o. Hjortåsen, Halla. Gullered: Hästhagen (Ndm). *Kind.* Tvärred: Alhammar, Askanäs, Dammsjön (Kj), Hjärtsbo, Hult, Högagärde, Kärrabo, S. Backa, Tvärredslund. Dannike: Boanäs. Länghem: Djurgården, Kinnaliden, Torpa. Finnekumla: Lindevik, Sjörred, Ängsön, Övrarp. Marbäck: Korpebo, Korpeboberg, Kärrabo, Sjö-Gunnarsbo, Skottek. S. Säm: Klevaberget, Sämsjön. Grönahög: Högaberg. Ljushult: Backa, Roppered. Roasjö: L. Apelnäs, Nygården. Sexdrega: Björsjöberget, Handbynäs, Kortö (vid bron) (GSn), Ringestena. Månstad: Björdal. S. Åsarp: Ladugården. *Ås.* Hällstad. Grovare: Bergsgärde. Härna: Åstorp. S. Ving: Nitta, Senered, Sjögården, Trogared, Tångagärde, Töve. Varnum: Kvarnagården, Kyrkarp, Väla. Rångedala: Gravryd, Hagen, Holmen. Äspered: Askanäs, Sundholmen. Toarp: Ekås, Germundared (S), Sjögården.

Malva moschata. — *Redväg.* N. Åsarp: ängsmark S om kkn, Ågården. Blidsberg: kyrkbron. Dalum: kkn. Timmele: Frännarp, Knuve, kkn, Vång. Vist: slakteriet. Brunn: Hede, Remma. Ulricehamn: badplatsen, stn. — Solberga: kkn. Kölingared: kkn. Böne: Gamlegården. Knätte: N om byn. Hössna: Hössnatorp, Åkesberg (Ndm). Gullered: Sjögared (id.). *Kind.* Dannike: Rölle. Marbäck: kkn. Ljushult: Roppered. Hillared: kkn. Sexdrega: Billeberg, Hagalundsjön, idrottsplatsen. Hulared: Reutersberg. *Ås.* Kärråkra: kkn (TH). Möne: kkn. Murum:

kkn. Hällstad: prästgården. Fänneslunda: kkn, St. Kärret. Härna: Björnsgården. Rångedala: Falskog, Klämmestorp, kkn. Äspered: kkn. Toarp: Gånghester, kkn.

M. pusilla. — *Redväg.* Blidsberg (Rdb). Vist: nya sopstn 1953. Ulricehamn: stn 1932. *Kind.* Marbäck: Storegården (UB). Sexdrega: Buttorp.

M. crispa. — *Ås.* S. Ving: prästgården (ogräs, 1926).

Hypericum montanum. — *Redväg.* Timmele: Knuve. Vist: 500 m S om Vistberget. Brunn: Kråkeboberg, Åsakullen. Ulricehamn (Rdb). *Kind.* Länghem: Kinnaliden (Hpn). Sexdrega: Björsjöberg (Tld). *Ås.* Varnum: vid vägen NV om Väla.

H. hirsutum. — *Redväg.* Ulricehamn 1782.

H. maculatum. — Allmän.

H. perforatum. — Ej konsekvent antecknad. *Redväg.* Blidsberg: Dalakvarn. Dalum: Flate, Krutbrännaregården, N om kyrkbron, stn. Vist: villastaden, Vistberget. — Kölingared: Kölingsholm (S). Gullered: S om kkn. *Kind.* Dannike: Ödegården. Finnekumla: Fästered. Gällstad: Bystad. Ljushult: Backa, Mariedal. Hillared: kkn, vid Såken, Torsered (G, S!). Sexdrega: Ringestena (GSn). S. Åsarp: Ladugården, Limmared. Nittorp: Moghult. *Ås.* Hällstad: Älmestad. Varnum: Kvarnagården, Väla. Rångedala: Gretlanda. Äspered: Hägnagärde. Toarp: Berget, kkn, vid Mellsåkern, N om Målsryd.

Helianthemum nummularium. — *Redväg.* N. Åsarp: Frugården (G), NV om Åsen. Kölaby: Sverkilstorp (åsen). Humla: »här och där» (dr Smedsberg enl. Hård). Dalum (Rdb). — Hössna: Valared (Ndm!). Gullered: vägkant 300 m V om kkn.

Drosera rotundifolia. — Allmän.

D. anglica. — *Redväg.* Kölaby: Yttern. Dalum: Tingvallakärret, Viesjön, Vinsarpsjön. Timmele: Bredsjön, Vång. Brunn: Kälkared, Åsunden. — Böne: Lönnarp. Liared: Gudebo (Kj). Gullered: Ubbared. Strängsered: Komosse, Strängseredsjön. *Kind.* Länghem: Angsjön, Sävsjön. Marbäck: Näsboholm. Grönahög (Kj). Hillared: Hösjön, Kärraholm, Mölnered, stn (Kj), Texlesjön (Bdg). Sexdrega: mell. Kortö o. Brokvarn (GSn), Långsjön, Ryasjön. Månstad: Tapplesjön. Dalstorp: sjön vid kkn. Hulared: Grytteredsjön. Nittorp: Spångasjön (Kj). *Ås.* Murum: Ömmern (TH). Hällstad: Björkensjöarna (TH), Lövåsen (Rökebo) (TH). Fänneslunda: sjön. S. Ving: Angsjön, Mogden, Nabben. Rångedala: Finnekumlasjön. Toarp: Gällsjön, Håljared, V om kkn.

D. anglica × rotundifolia. — *Ås.* Murum: mosse V om Ömmern (S).

D. intermedia. — *Redväg.* Dalum: Viesjön, Vinsarpsjön. Brunn: Kälkared, Toppsjön. — Kölingared: Sandvik. Böne: S om Vinsarpsjön. Knätte: nedom Lunds by. Hössna: S om Torinstorpet. Strängsered: Brämene, Flärred (Ndm), Komosse (Old). *Kind.* Dannike: Backa, Boanäs. Länghem: 8 lok. Marbäck: Korpebo (ÖN). S. Säm: Attorp (Kj). Gällstad: Rånnavägsjön, Toppåsasjön (ÖN). Grönahög: Komosse (Old). Sexdrega: Långsjön. Dalstorp: Kvarntorpet. Nittorp: St. Spångasjön (Kj). *Ås.* Möne: Viesjön (TH). Hällstad: Bredsjön (TH), Lövåsen

(Rökebo) (S). Toarp: Lillevesjön (S), Sjögårdssjön. (Ej konsekvent antecknad från Ås härad.)

Viola odorata. — Förvildad i och invid gamla trädgårdar. — *Redväg.* N. Åsarp: Valunda, Åsen. Dalum: Silarp. Brunn: Kråkebo. — Hössna: kyrkogården, dike vid prästgården. Gullered: prästgården (Ndm). *Kind.* Gällstad: Torsbo. *Ås.* S. Vånga: Rosendal. Hällstad: Hof. Fännes-lunda: Strömshov. S. Ving: Romsås. Varnum: Dållebo. Rångedala: prästgården.

V. hirta. — *Redväg.* Smula: åsarna i byn, L. Fagerås, bron över Skråern. N. Åsarp: Ekeberga, prästgården, Åsarp Rättaregården. Kölaby: kkn, Långekra, Rynninge, Sverkilstorp (åsen o. sydsluttning N om sjöarna). Humla: Smedsgården, åsryggar vid Ätran. Blidsberg: Björnarp, Dalakvarn, Hallabo, Kässeberg (baktrågen). Dalum: 14 lok. Timmele: Kattåkra, Knuve, mell. Lena o. Vång, Nöre. Brunn: Kråkebo. Ulricehamn: Lindängen (ÖN). — Böne: Marbohemmet. Knätte: kullarna 500 m S om kkn. Liared: Gudebo. Hössna: Lönnåsen (Nils Gustafson), Valared (Ndm). *Kind.* Länghem: Torpa. *Ås.* Hällstad: Pjukarp vid skjutbanan. S. Ving: Bogakvarn, Sjöslätt, Tångagärde. Varnum: Boarp. Äspered: Vatunga.

V. mirabilis. — *Redväg.* Blidsberg: Dalakvarn, Kässeberg (baktrågen). Dalum: Silarp (vid bäcken). Timmele: Kattåkra, Knuve. Brunn: Kråkeboberg, Kälkared, Remma, Åsakullen. Ulricehamn (Rdb). — Kölingared: Valshalla (G, S). Liared: Tuskan. Hössna: Grubbäcken, Halla, Hjortåsen, Krokstorp, Sjöryd, Önnarp. *Kind.* Tvärred: Hand, mell. Rude o. Tvärredslund. Dannike: Rölle. Finnekumla: Övrarp. Marbäck: Hyared (S), Korpeboberg, Kärrabo. S. Säm: Klevaberget, Vegby. *Ås.* Varnum: Nitta (Kj). Rångedala: Algutstorp, Gravryd. Äspered: Vatunga. Toarp: Skinnarehult (U).

V. riviniana. — Allmän.

V. reichenbachiana. — *Ås.* Toarp: Bråthult (U).

V. reichenbachiana* × *riviniana. — *Ås.* Toarp: Bråthult (S).

V. rupestris. — *Redväg.* Smula: åsarna i byn, Kolbrandstorp, bron över Skråern. N. Åsarp: Frugården, Hansagården, prästgården. Kölaby: Rynninge (åsen), Sverkilstorp (åsen), Tummarp. Blidsberg: Björnarp, Dalakvarn, Deragården, Hallabo, Skattegården (grustag). Dalum: Flate, Gustavsberg, Krutbrännaregården, S om kyrkbron, Plate (G), Silarpskullen, Svenstorp (moränkulle vid Ätran), 500 m N om Ögården. Timmele: Kattåkra (G), Nöre (G), Vång. — Knätte: kullarna 500 m S om kkn (S). Hössna: Kinnared (getryggen) (S). — Karta (fig. 2).

V. canina. — Allmän.

V. canina* × *montana. — *Redväg.* Kölaby: Stommen. — Gullered: mell. kyrkbyn o. Ubbareds by. *Ås.* S. Ving: Aspanäs (jvgsskärningen). Äspered: Vatunga.

V. canina* × *riviniana. — *Redväg.* N. Åsarp: Ekeberga. Brunn: L. Ekered. *Ås.* S. Ving: Aspanäs, Säby. Äspered: Vatunga. Toarp: Berget (S), Råslätt (S).

V. canina* × *stagnina. — *Redväg.* N. Åsarp: Dörraholm. Dalum: Silarpskullen (G), Ögården.

V. montana. — *Redväg.* Böne: 100 m Ö om kkn. *Kind.* Gällstad: bäcken Boarp—Frölunda. *Ås.* S. Ving: Aspanäs (jvgsskärningen). Äspered: Vatunga.

V. montana* × *riviniana. — *Redväg.* N. Åsarp: Valunda. Timmele: bäckdal vid banvaktsstugan.

V. stagnina. — *Redväg.* Dalum: Nöresjön, sjöhålan NO om Nöresjön, Tingvallakärret (G), Ögården.

V. epipsila. — *Redväg.* N. Åsarp: Dörragården. Kölaby: Stommen (vid ån), fuktig ängsmark V om Trädets gård. Dalum: Vinsarpsmossen. Timmele: Bredsjön, Gryteskog, Mölnarp, Sjöbacka, Vång. Brunn: Kälkared. — Böne: N om Backgården. Gullered: Skattegården. Strängsered: Komosse (Old). *Kind.* Länghem: Djurgården. Grönahög o. Ölsremma: Komosse (Old). *Ås.* Möne: mossen S om kkn. Hällstad: Hof, Kronogården, kkn, Lunden, Snugge. Grovare: Sjögården. Härna: Sassarp (vid Grundsjön). S. Ving: Angsjön, Hökerum, mell. Hökerum o. Svederna. Rångedala: nedom Finnekumla (G), mossen S om Marsjön.

V. epipsila* × *palustris. — *Ås.* S. Ving: Angsjön, Hökerum, mell. Hökerum o. Svederna. Rångedala: Finnekumla 1924 (G).

V. palustris. — Allmän.

V. arvensis. — Allmän.

V. tricolor. — Allmän.

(*Viola*-formerna äro — med undantag av de ur Riksmuseets hb. anförda — granskade och bestämda av C. Blom.)

Daphne mezereum. — *Kind.* Marbäck: nära Björkered (S), Hyared (vid bäcken). [*Ås.* Toarp: Häljared (fv. i rösena i byn) (S).]

Peplis portula. – *Redväg.* Dalum (Rdb). Timmele: Källeberg (G). — Liared: Tuskan (Ndm). *Kind.* Länghem: Torpa (Lillsjön). Ljushult: backen Ö om kkn 1928. Hillared: Veka (Hpn). *Ås.* Hällstad: Dannarp (S), Lursten. Härna: Tissås, Östergården. Toarp: Häljared 1914 (G, S).

Lythrum salicaria. — Allmän.

[*Epilobium hirsutum.* — *Ås.* Toarp: Bygd (G, U). — Förvildad eller odlad?]

E. parviflorum. — *Ås.* Varnum: Väla (1 ex. 1923).

E. montanum. — Allmän.

E. montanum* × *obscurum. — *Ås.* Toarp: Lindås (S).

E. montanum* × *palustre. — *Kind.* Ljushult: Aplareds stn. *Ås.* Toarp: Germundared (S), Gånghester (S), Målsryd (S).

E. montanum* × *roseum. — *Ås.* Toarp: Kråkhult (vägdike).

E. collinum. — *Redväg.* Dalum: Plate. Vist: Vistberget. Brunn: Kråkeboberg. Ulricehamn: stn. — Kölingared: Valshalla. Böne: Åfärd. *Kind.* Tvärred: Alhammar. Länghem: Kinnaliden. Marbäck: Korpebo, stn, jvgn vid tunneln. Grönahög (Kj). Hillared: bergsstup vid Såken, Torsered. *Ås.* Varnum: Nitta, SV om Väla. Rångedala: kkn. Toarp: Kovra (G, S), Mellsåkern, N om Målsryd, Skälvarås (G).

E. collinum* × *montanum. — *Ås.* Toarp: Målsryd (S).

E. roseum. — *Kind.* Finnekumla: Fästeredsund (Kj). *Ås.* Äspered: Vatunga. Toarp: Kråkhult (vägdike, sedan 1942).

E. adenocaulum. — Sällsynt inom Redvägs och Ås' nordligare sock-

nar, där den blivit sedd först under de sista åren. — *Redväg.* N. Åsarp: Ekeberga kvarn, Hansagården. Humla: Väddåkra. Blidsberg: Dalakvarn, Hallabo, N om stn. Dalum: Flatekvarn, S om kkn, stn, Vinsarp 1926 (G). Timmele: Kattåkra, Klockaregården, Nilsagården, stn. Vist: utmed vägen till Bjättlunda (G), Fotåsen, Ö om Härstorp, nya sopstn, Nyboholm, Vistaholm, Åsunden. Brunn: Brunnsnäs, dalen mell. Kråkeboberg o. Åsakullen, L. Ekered, prästgården, Remma, St. Ekered, Åsakullen. Ulricehamn: kreatursplatsen, Lindängen, Oset, södra stadsdelen, Åsunden, Åsundens trikåfabrik. — Kölingared: Söre, Årås. Böne: Backgården, kkn, prästgården, S om Vinsarpsjön, Åfärd, mossen S om Åfärd, vid Ätran. Liared: Bergabron. Hössna: Krokstorp, kkn, prästgården, Rönnesmad. Gullered: Karlabo. *Kind.* Tvärred: Alhammar, Askanäs, Bodarna, mell. Brosered o. Ekåsen, Hjärtsbo, Högagärde, Majblomman, utmed Tolken. Dannike: Forsa, Ramsjön, Rölle. Länghem: Djurgården, vid bäcken mell. Haldarp o. stn, Ingestorp, mossen Ö om kkn, S om Stakagården, stn, Torpa, Varred. Finnekumla: Finnekumla gård, Fästered, mell. Fästered o. Vegby, Lindevik, Stockholmen. Marbäck: bäcken S om Hyared, Korpebo, Källebacka, Kärrabo, Näsboholm, pkt 234, stn, vid Åsunden. S.Säm: Attorp, Bossgården, Klevaberget, Ramasjön, Vegby. Gällstad: Bystad, Bystadsjön, mell. folkskolan o. Sämsjön, Götåkra, Intorp, Lid, Påbo, Rånnaväg, Örsten. Ljushult: Aplared 1920 (fotbollsplanen), d:o stn (L), Dalen, Sjögården, Skanssjön. Hillared: Hinnared, Lagsjön, Mölnered, stn, Torsered, Åsendal (G, L). Sexdrega: Buttorp, kyrkbron, Sandsjönäs. Månstad: Björdal, Melltorp, Månstadkulle, Rösered. Dalstorp: Gundlabo, SV om kkn, Växtorp. Hulared: Grytteredsjön o. S om densamma, Reutersberg, Stålared. S.Åsarp: Limmared (Lillån), Skårtebo. Nittorp: Haga, Hornhult, Moghult. *Ås.* Kärråkra: Sjö. S.Vånga: Rosendal. Möne: Bolstorp. Murum: Murarp, Rya. Hällstad: Kronogården, kkn, Pjukarp. S.Ving: Aspanäs (G), Bogakvarn, Ekeslunda, Hökerum (G), Mastunga, Mogden, Slumsvik, Tomta, Vätersholm. Varnum: Kvarnagården, vid sjöarna. Rångedala: Falskog, Finnekumla, Gretlanda, Rångedalaån (genom hela socknen). Äspered: mell. kkn o. Åsen, Sundholmen, Tångagärdshage, Vatunga. Toarp: Andared, Bygd, Dalsjöfors, Drared, Gånghester, Hjortryd, Kerstinsgärde, Kråkhult, kkn, Madtorps såg, Målsryd, längs Rångedalaån, Sjögården, Skenstad, Slätthult, Starhester, stn. — Stadd i kraftig spridning. Traktvis släktets vanligaste art. Jfr även Westfeldt 1938.

E. adenocaulum* × *palustre. — *Redväg.* Vist: Vistaholm (vägdike) (G). *Kind.* Hillared: jvgskorsningen Ö om Åsendal (G, S) (det. C. Blom).

E. adenocaulum* × *roseum. — *Ås.* Toarp: Kråkhult 1954 (det. C. Blom).

E. rubescens. — *Redväg.* Vist: Vistaholm (vägdike, 1950).

E. obscurum. — *Ås.* Toarp: Bonarp (U), Dalsjöfors (G), Gånghester (L, S, U), Skälvareds svedjor 1887 (G).

E. obscurum* × *palustre. — *Ås.* Toarp: Lindås 1909, 1914 (G, S).

E. palustre. — Allmän.

Chamaenerion angustifolium. — Allmän.

Oenothera biennis. — *Kind.* S. Säm: Vegby (ÖN). Sexdrega: kkn. *Ås.* S. Ving: prästgården 1924, Tolkabro 1925. Toarp: Gånghester (stn).

[*Circaea lutetiana.* — *Ås.* Toarp: Bygd (G). — Odlad eller förvildad?]

C. alpina. — *Redväg.* Timmele: Kattåkra. Vist: Hössnavägen. Brunn: Kråkeboberg, Röstesjön. Ulricehamn (G, S). *Kind.* Tvärred: Ruggebo. Länghem: Hovsnäs (näset), Kinnaliden (Hpn). Finnekumla: Fästered (Kj). Marbäck: mell. Korpebo o. Näsboholm (ÖN). S. Säm: Klevaberget. Ljushult: vid Såken (Claes Grill). Hillared: Tåstaberget (Hpn). *Ås.* Toarp: Bygds skog (B, G), Råslätts hage (B, G).

Myriophyllum verticillatum. — *Redväg.* Kölaby: Trädet (i Ätran). Humla: Väddåkra (i Ätran) (ÖN). Vist: Åsunden. — Knätte: kvarnen. *Kind.* S. Säm: Attorp (Kj). *Ås.* Härna: Gärdsjön. S. Ving: Mogden. Varnum: Marsjön (S & S), Mellsjön (id.), stn. Rångedala: Finnekumlasjön.

M. alterniflorum. — T. allmän.

Hippuris vulgaris. — *Redväg.* N. Åsarp: Skägga, Valundasjön. Kölaby: Sverkilstorp. Dalum: Flatekvarn, kkn (Kj). Timmele: kyrkbron, Nygården. — Knätte: byn, kvarnen. Gullered: Nolsjön (Ndm). *Kind.* Hillared: Veka. Sexdrega: Kortö (GSn), kyrkbron. *Ås.* Möne: Viesjön (TH). Murum: Skålarp, Årred. Hällstad: Brunstorp, kkn, L. Björken (TH), Pjukarp, prästgården (TH), Älmestad. Härna: sjöarna. S. Ving: Hökerum, S om kkn, Nygården, Sjöslätt. Tärby o. Rångedala: Finnekumlasjön. Varnum: sjöarna kring kkn, stn. Äspered: Vatunga. Toarp: Toarpsdals stn.

Cornus sanguinea. — *Redväg.* Ulricehamn 1782.

C. suecica. — *Redväg.* Ulricehamn (Rdb). — Kölingared: Kölingsholm (Kj). *Kind.* Länghem: Angsjön (Kj), Ingsvallen (ÖN), Simonsberg. S. Säm (Kj). Ljushult: Dalen, kyrkskolan, Mariedal, Näset (Ldg), Roppered (G, S). Sexdrega: Björsjöberget, Björsjön. *Ås.* Fänneslunda: Karstorp. S. Ving: Mogden, Tångagärde. Tärby: mell. Ässtorp o. Boarp. Rångedala: Gretlanda, Ormåsa. Äspered: Hallabron, kkn, S om Lövaskog, Åsen. Toarp: Häglared, Kråkhult (G, S), Kulla (G, S), Källa (G), Tränghult (Ldg).

C. alba. — *Redväg.* N. Åsarp: prästgårdskärret. Ulricehamn: Oset. *Kind.* S. Säm: Vegby stn. Ljushult: Aplared. *Ås.* Hällstad: kkn. Varnum: Boarp. Toarp: Drared, Kronäng.

Hedera helix. — *Kind.* Roasjö: Nygården (S, jfr sid. 655).

Hydrocotyle vulgaris. — *Kind.* Hillared: Gälaredsån (Kj), Hinnared, Lagsjön. Sexdrega: Buttorp (Tld!), Hagalundsjön (GSn), Kortö kvarn (id.), sågen (Hpn). *Ås.* Toarp: Sjögårdssjön (S).

Sanicula europaea. — *Redväg.* Brunn: Kråkeboberg. — Se vidare Westfeldt 1947.

Astrantia major. — *Kind.* Hillared: Skedeskamma (fv.).

Anthriscus silvestris. — Allmän.

A. cerefolium. — *Ås.* Äspered: Vatunga 1 ex. 1948.

Myrrhis odorata. — *Redväg.* Kölingared: Årås. Gullered: Hallen (Ndm). *Kind.* Dannike: Stålåsen. *Ås.* Härna: Tissås. S. Ving: Bredaslätt. Varnum: Stommen, Ågården. Toarp: Drared.

Torilis japonica. — *Redväg.* Ulricehamn (Rdb).

Cicuta virosa. — *Redväg.* Dalum: Viesjön. Timmele: Annestorpsjön, Kroksjöarna. *Kind.* Länghem: Djurgården (Åsunden). *Ås.* Möne: Viesjön. Hällstad: Björkensjöarna (S), Ömmern (TH). Härna: sjöarna. S. Ving: Viskan nedom Mogden. Varnum: Viskan vid Bossgården, Brogården, Kvarnagården o. Ågården, Marsjön, Mellsjön. Rångedala: Finnekumlasjön. Toarp: Lindås (G, S).

Carum carvi. — T. allmän.

Pimpinella saxifraga. — T. allmän.

Aegopodium podagraria. — T. allmän.

Sium latifolium. — *Redväg.* T. allmän längs Ätran från Smula till Åsunden.

Oenanthe aquatica. — *Redväg.* Kölaby: Trädet (i Ätran) (S). Humla: Drättekvarn. Timmele: Ätran S om kkn. Vist: Brogården (avar i Ätran vid Slottet). Ulricehamn: Oset.

Aethusa cynapium. — *Redväg.* Smula: Bredene. Blidsberg: vid kkn (Ö om Ätran). Vist: nya sopstn. Brunn: Brunnsnäs, nya kyrkogården, vägkant vid Toppsjön. Ulricehamn: stn. — Böne: prästgården. *Kind.* Länghem: Torpa. *Ås.* Hällstad: Hof. Varnum: Ågården.

Selinum carvifolia. — *Redväg.* Kölaby: Stommen. Blidsberg: vägskälet S om Påarp. Dalum: SO om Krutbrännaregården, V om stn, Vinsarpsmossen. — Solberga: Baggekvarn. Hössna: Hössnatorp, Krokstorp (Ndm). *Kind.* Sexdrega: Buttorps såg, Kortå kvarn (GSn), stn vid Ätran (G). *Ås.* Möne: Bengtsgården, Rävike. Hällstad: dalen mell. Hof o. Knapagården, Lunden. S. Ving: Bogakvarn.

Angelica silvestris. — Allmän.

Peucedanum ostruthium. — *Redväg.* Gullered: Sjögared. *Kind.* Dannike: Slätten, Stålåsen. Hillared: nedlagt torp V om Torsered. Sexdrega: Högagärdet (Hpn), Ryasjö (torp). *Ås.* Grovare: Bränning. Härna: Tissås. S. Ving: Romsås. Varnum: Stommen. Äspered: Åsen. Toarp: Drared, Ekås, Hagabo (CSg), Stockhult, Tubbared.

P. palustre. — Allmän.

Pastinaca sativa. — *Redväg.* Kölaby: Trädet. Blidsberg: stn. — Solberga: getryggen vid kkn. *Kind.* S. Säm: Vegby stn. *Ås.* Hällstad: Hof. S. Ving: Kärr.

Heracleum sphondylium ssp. ***sibiricum.*** — *Redväg* o. *Ås.* Allmän. Sedd i samtliga socknar. *Kind.* T. allmän. Ej funnen i Länghem, Ljushult, Hillared, Roasjö o. Sexdrega.

Daucus carota. — *Redväg.* Ulricehamn: stn.

Chimaphila umbellata. — *Ås.* Murum: Påarp (Rdb).

Moneses uniflora. — *Redväg.* N. Åsarp: prästgårdskärret. Kölaby: Lundby skog (Bgt), vid vägen till Solberga. Dalum: Vinsarp, Vång. Timmele: vid vägen till Hössna, Knuve. Brunn: Kråkeboberg, Röstesjön, Åsakullen. Ulricehamn: sanatorieparken. — Knätte: mell. Lönnern o. Årred, Nåtared, Slätthult. Hössna: Fagrared. Gullered (Ndm). *Kind.* Grönahög: Stommen vid Högabergs kvarn. Ljushult: Aplared (tunneln), Gränd, mell. Nytorp o. Roppered. *Ås.* Kärråkra: Boarp. S. Vånga: Bosarp. Hällstad: Krakared, St. Björken, Tågården. Fän-

neslunda: Sotared. S. Ving: Arvidsgården, Granbygget, Hästskoslätt, Kärr, Lottenborg, Lövaskog, Mogden, Töve, Öndared. Tärby: Mellsjön. Varnum: mell. sjöarna. Äspered: Hallabron. Toarp: Kulla skog (G), Mellsåkern (Hpn), ca $^1/_2$ km S om Målsryds stn (Ldg), Toarps Stom (fattighuset) (G).

Pyrola minor. — Allmän.

P. media. — *Redväg.* Dalum: Vång. — Gullered: Sjögared (Ndm). *Kind.* Ljushult: Ropperedsjön (G). Sexdrega: Björkås (Tld), Björsjöberget. *Ås.* Äspered (Kj). Toarp: Bygd (G, S), Kulla skog (G), Slätthult (G).

P. rotundifolia. — T. allmän.

P. chlorantha. — *Redväg.* Kölaby: Lundby skog (Bgt). Dalum: Vinsarp (Rdb). Brunn: Åsakullen. Ulricehamn (Rdb). — Kölingared: Valshalla. *Kind.* Länghem: Torpa. Marbäck: Bäckagården (Kj), Korpebo (ÖN), Åsen. S. Säm: N om Hjortsbacka (ÖN), Vilöta (id.). Grönahög: Torsberg. Ljushult: Dalen, Dannkället (G), Skanssjön. Hillared: Hinnared. Sexdrega: Oxhagen (Hpn). Hulared: SV om Grytteredsjön. *Ås.* Härna: Anksjön. S. Ving: Öndared. Toarp: Bygd (G), Kulla skog (G), Målsryd (G, S), Nygårds mosse (G), Tokarpsskogen (G).

Ramischia secunda. — Allmän.

Monotropa hypopitys. — *Redväg.* Kölaby: Lundby skog (Bgt). Humla: Väddåkra (ÖN). Brunn: Kråkeboberg, Åsakullen. — Solberga: N om Ingabo. Kölingared: Hemryds skog (Kj). Liared: Tuskan (Ndm). Hössna: Pinebo. Gullered: Sjögared (id.). *Kind.* Tvärred: Sjöbo. Länghem: Haldarp. Marbäck: Bredgården. Gällstad: St. Bystad. Ljushult: Arnäsholm (E. Ränge), Gränd, Näset, Stommen (id.). Hillared: Göshult. Roasjö: sågen vid Åsen. Sexdrega: NV om Angsjön (GSn), Björkås, Brattåsen (GSn), Buttorp (Tld), Dalen (id.), Ljunghagen (id.), Ringestena (GSn). Dalstorp: Boarp, prästgårdsskogen (Kvl). Hulared: Hackered. *Ås.* Hällstad: Lövåsen (Rökebo). S. Ving: Håkabo, Säby. Rångedala: Algutstorp, Madtorp. Äspered: Borghult, Lövaskog, Sundholmen, V om Åsen. Toarp: Germundared (G), Lökared (S), Målsryd (G), mell. Smedsås o. Stålarp, Stålarps skog, Övrarp.

Ledum palustre. — *Redväg.* N. Åsarp: Valundasjön. — Solberga: N om Ingabo. Fivlered: Aplaskog, Källeryd, vid Yttern. Kölingared: Gunnered, Tåhult. Liared: Vrån. Gullered: Sjögared (Ndm). *Kind.* Länghem: Ö om Dunsjön (GSn). S. Säm: Hjortsbacka (ÖN). Grönahög: Östentorp (Kvl). Ljushult: Aplareds gård, Handbynäs. Hillared: Björsjön (GSn), Gälared (G). Roasjö: vid gla vägen till Redslared (Hpn). Sexdrega: NV om Angsjön (Martin Svensson), Billeberg (Hpn), Röstorp (id.), St. Snärsbo (id.). Dalstorp: Karlsbo (Kvl). Hulared: Lund. *Ås.* Fänneslunda: Sotared. S. Ving: strax V om Bogakvarn, Bredsjön. Äspered: Hallabron. Toarp: Målsryd, Nygårds mosse (G, S), Skår (G, S), mell. Tränghult o. Tubbared (Ldg).

Andromeda polifolia. — Sällsynt i Ätradalen och norra delen av *Ås* härad. *Redväg.* N. Åsarp: prästgårdskärret, Valunda. Dalum: Tingvalla. Vist: Snipesjön. — Fivlered: Yttern. Hössna: Kilahemmet, L. Fagrared, Torinstorpet. Gullered: Ekesbo (Ndm). Strängsered: Hästhagen,

Komosse. *Kind.* Länghem: N om Angsjön, Borgsjön, Djurgården, Forsa, Ingestorp, Ö om kkn, Måleksområdet, Rings mosse, Ruggebo. Grönahög o. Ölsremma: Komosse. Ljushult: Skanssjön (G). Hillared: Svederna, Åsendal. Sexdrega: Björsjön, Ensberg, Källered, Lillsjön. Månstad: Månstadkulle (Kj). Hulared: SV om Grytteredsjön. Nittorp: Flathult, Moghult. Ljungsarp: Kättsjö, S om Pajet. *Ås.* Hällstad: Hällstadmossen (TH), L. Björken (TH), N om prästgården (S). Äspered: Gullestorpsjön, mossen SV om kkn, Lövaskog, Nygården, Sundholmen (Kj), Åsen. Toarp: Drared (Kj), mindre mosse mell. Häljared o. kkn, Kulla (G), nära kkn, Tjärnsjö (G).

Arctostaphylos uva-ursi. — Saknas helt i övre Ätradalen o. i *Ås* härad. *Redväg.* Gullered: Ekesbo (Ndm), Sjögared. Strängsered: Norhestra. *Kind.* Länghem: Bredsjön. Marbäck: jvgsbanken S om Åsundens stn. Ölsremma: Mörkö. Ljushult: Roppered (S). Hillared: Åsendal. Sexdrega: N om Hagalundsjön, Kortå (GSn), Starred (Tld), Tjuvakulle. S. Åsarp: Sjörred. Nittorp: SV om Gölingstorp. Ljungsarp: grustag vid kkn, t. allmän vid Lagmanshagasjön, Mörksjön, längs Unnarydsvägen.

Vaccinium vitis-idaea. — Allmän.

V. uliginosum. — Allmän.

V. myrtillus. — Allmän.

V. oxycoccus ssp. ***vulgare.*** — Allmän.

V. oxycoccus ssp. ***microcarpum.*** — *Redväg.* Dalum: Vinsarp. — Knätte: Lunds by. Hössna: Önnarp. *Ås.* Toarp: nära Lökared (S).

Calluna vulgaris. — Allmän.

Erica tetralix. — Allmän inom större delen av området. Saknas nästan helt i Ätradalen N om Åsunden, där den endast noterats från: *Redväg.* Kölaby: Kråkeberg, Sverkilstorp. Timmele: Nilsagården.

Empetrum nigrum. — Allmän.

Primula veris. — Allmän i Ätradalen N om Åsunden. — *Redväg.* Smula: 3 lok. N. Åsarp: 8 lok. Kölaby: 6 lok. Humla: åssluttningarna längs Ätran. Blidsberg: 12 lok. Dalum: allmän i dalgången, dessutom sedd vid Farstorp, Vedåsa, Vinsarp, Vång. Timmele: 5 lok. i dalen, dessutom vid Frännarp, Yttre Vång. Vist: Ubbarp. Brunn: Gäla, Kråkebo, Kråkeboberg, Kälkared, L. Ekered, Långsered, Remma, Snipe, St. Ekered, Åsakullen. Ulricehamn: Hössnavägen. — Solberga: åsryggen N o. S om kkn. Kölingared: Baggekulla, Ingared, Kölingsholm, Marbohemmet, Valshalla. Böne: 1 km N om kkn, prästgården. Knätte: Björkvik. Liared: Skeppsholmen. Hössna: Hössnatorp, Lönnåsen. Gullered (Ndm). *Kind.* Tvärred: Rude, N om Tvärredslund. Länghem: Torpa (vid slottet o. på näset). Finnekumla: Fästered. Marbäck: Björkered, Källebacka, Kärrabo, Näsboholm, Storegården. S. Säm: Attorp, Hjortsbacka, N om Iglasjö, Vegby. *Ås.* Hällstad: Gammalstorp. Grovare: Grosken (fv.). S. Ving: utmed jvgn mot Brunn, Hästhagen, Sjöbredared, Vätersholm. Äspered: Sundholmen, Vatunga. — Karta (fig. 3).

P. farinosa. — *Redväg.* Smula: L. Fagerås. N. Åsarp: Alvared, Björkelund, Dörragården, Fingerkvarn (G), Frugården, kärr 500 m V om Hansagården, N om jvgsbron, N om kkn, prästgårdskärret, Valunda,

Åsen. Kölaby: Borred, Lundby (Bgt), S om stn, Stommen, Sverkilstorp (sjöarna), Trädets gård, Vägagården (Bgt). Blidsberg: Björnarp, Hallabo, SV om Påarp. Dalum: Flate, S om Krutbrännaregården, N om kyrkbron, Silarp, stn, Viesjön, Vinsarp, Vinsarpsmossen, N om Vångs by. Timmele: Bredsjön, Gryteskog, Lena, Mölnarp, Redvägsborg, St. Kroksjön, Töve, Vång. Vist: Ubbarp. Brunn: Gäla, Kråkeboberg, 500 m V om kkn, Kälkared, Kättsered, Långsered, Röstesjön, Snipe (ÖN), stn, St. Ekered. Ulricehamn (L): Lindängen, Åsunden (G), östra stadsdelen (Kj). — Solberga: Baggekvarn. Böne: Hällunda, Hyared, Marbohemmet. Knätte: kkn, Lunds by. Hössna: Brunsered, Duvered, Gärdet, Hillared, Hössnatorp, Kinnared, Krokstorp, Sillebacken, Valared, Önnarp. Gullered (Ndm). *Kind.* Marbäck: Korpebo (jvgsskärningen) (ÖN!). *Ås.* Kärråkra: kkn. Möne: Bengtsgården, Bolstorp, mossen S om kkn, Sjöarp, Sketnabäck, Östergården. Murum: kärr NO om kkn (TH). Hällstad: Brunstorp, Gisslarp, Hof, Katthög (TH), kkn (S), Kärrängsås, Lunden, Påvagården, Skattegården, Åsen, Älmestad. Härna: Anksjön, byn, N om Gärdsjön. S. Ving: Backen, Bogakvarn, Fäbroarna, Hökerum, S om kkn, Mogden (vid Nygården, Svederna o. Vätersholm) (från den sistnämnda lokalen i L), V om Romsås, nedom Tissås, Trogared, Tåbol, Töve. Rångedala: Gretlanda. Äspered: ängarna Ö om kkn (G), Sjötorp (G). Toarp: mell. Bygd o. Skäftingsbacka (A. O. Olson). — Karta (fig. 5).

Hottonia palustris. — *Redväg.* Kölaby: S om Borred. Dalum: Krutbrännaregården, S om kkn, Plate. Timmele: Klockaregården, Kroken, S om kkn, Nygården, Nöre, St. Kroksjön. Vist: Brogården (Slottet), NV om Rydet. — Böne: vid Ätran. Knätte: kvarnen i byn. Strängsered: Strängseredsjön. *Kind.* Sexdrega: Buttorp (Tld), sågen (Hpn). *Ås.* Murum: Bössan, Skålarp. Hällstad: Granared (TH), St. Björken (TH). Härna: Anksjön, Gärdsjön. S. Ving: Viskan nedom Backen. Varnum: sjöarna, stn. Rångedala: Finnekumlasjön.

Lysimachia vulgaris. — Allmän.

L. nummularia. — *Redväg.* Vist: nya sopstn. — Solberga: kkn. *Kind.* Marbäck: Korpebo. *Ås.* Hällstad: SV om kkn, prästgården. Äspered: Hallabron, Sundholmen (vid Tolken). Toarp: S om Bygd, Gånghester, Målsryd.

L. thyrsiflora. — Allmän.

Trientalis europaea. — Allmän.

Anagallis arvensis. — *Ås.* Härna: prästgården 1925. S. Ving: Aspanäs 1938. Toarp: St. Bygd (G).

A. femina. — *Ås.* Toarp: St. Bygd (G).

Centunculus minimus. — *Redväg.* Ulricehamn (vid gångstigen till Brunnsnäs) 1874 (L).

Armeria maritima v. ***elongata.*** — *Redväg.* Ulricehamn 1782.

Gentiana pneumonanthe. — *Redväg.* Vist: Ubbared 1953 (jfr sid. 653). Ulricehamn 1782. *Kind.* Hillared: Gälared (Såkens strand) (G). Sexdrega: Björsjön (Hpn), N om Buttorps kvarn (Tld!), Hagalundsjön (Hpn). Månstad: N-ändan av Tapplesjön (ÖN). *Ås.* Fänneslunda

(Hård). Rångedala: Gretlanda (Henning Hjelmstedt), prästgården (G, S).

Gentianella campestris. — *Redväg.* Smula: åsarna (även vitblommig). N. Åsarp: Björkelund, Åsarp Rättaregården, Åsen. Kölaby: Borred, Tåstarp. Humla: N om kkn, Smedsgården. Blidsberg: Dalakvarn, Hallabo, Holmen. Dalum: Flate, Silarpskullen, S om stn, Vinsarp (vitblommig) (S). Timmele: 6 lok. Brunn: Kälkared, Röstesjön. — Solberga: Baggekvarn, åsryggen S om kkn. Kölingared: Ingared, Torpa. Knätte: moränkullarna 500 m S om kkn, Slätthult, längs vägen till Åfärd. Hössna: 7 lok. Gullered: Backen, St. Höghult. *Kind.* Grönahög: Östentorp (Kvl). Ljushult: Dalen. Sexdrega: Buttorp, Målek (Tld), vid Ätran (G, S). Dalstorp: Gundlabo (Kvl). *Ås.* Kärråkra: kkn, Sjö. S. Vånga: Backabo. Möne: Östergården. Murum: kkn. Hällstad: 6 lok. Grovare: Bränning. Härna: Anksjön, Björnsgården, N om Gärdsjön. S. Ving: 14 lok. Tärby: V om byn. Varnum: Bossgården, Dållebo (G), Hultet. Rångedala: Byttorp, Falskog, mell. Falskog o. Mada (G), Holmen (G), kkn (S), Nordhemmet. Äspered: Hägnagärde. Toarp: Häljared (G), Klev (G), kkn (G), Målsryd, mell. Målsryd o. Slutes (G), Tränghults såg (G).

G. amarella. — *Redväg.* Ulricehamn 1782. *Ås.* Möne (Rdb). Hällstad: vägkant S om kkn (G). Toarp: Häljared 1887 (G).

Menyanthes trifoliata. — Allmän.

Vinca minor. — *Redväg.* Dalum: N om Vång (fv.). *Ås.* Tärby: kkn (fv.).

Fraxinus excelsior. — Allmän.

Convolvulus arvensis. — *Redväg.* Blidsberg: vid kkn Ö om Ätran. Ulricehamn: stn (G).

Calystegia sepium. — *Redväg.* N. Åsarp: Ekeberga. Dalum: kkn, stn. Vist: nya sopstn, villastaden. Ulricehamn: vid Åsunden (uppgives av Rudberg 1902 och har bibehållit sig sedan dess). *Kind.* Finnekumla: Sundet. Marbäck: byn. *Ås.* Murum: byn. Hällstad: Påvagården. S. Ving: Romsås. Toarp: S om Bygd, kkn (G), Målsryds stn.

Cuscuta europaea ssp. ***genuina.*** — *Redväg.* Dalum: vid kkn 1936. Vist: nya sopstn 1951 (ÖN). Brunn: Kråkebo 1953. Ulricehamn (Rdb). — Kölingared: Kölingsholm. *Kind.* Marbäck: Storegården (UB). S. Åsarp: Oppensten (UB), Ås 1952. *Ås.* Fänneslunda: herrgården, Kullatorp, Sotared (G. Holmqvist). S. Ving: Ekenäs, Nollyckan. Rångedala: Håkansgården.

C. epithymum ssp. ***Trifolii.*** — *Kind.* Länghem: Torpa (L, S). *Ås.* Toarp: Bygd (G). — Se Witte 1936.

C. epilinum. — *Ås.* Hällstad: Snugge 1923 (S).

Polemonium coeruleum. — Förvildad över hela området.

Lithospermum arvense. — *Redväg.* Blidsberg: utmed vägen till Kässeberg, stn. Dalum: stn. *Kind.* Länghem: Torpa. *Ås.* S. Ving: Aspanäs (S).

Echium vulgare. — *Redväg.* N. Åsarp: stn 1952 (ÖN). *Kind.* Dannike: Slätten (Ldg). *Ås.* Äspered: Hallabron 1950—1953.

Borago officinalis. — *Ås.* Härna: prästgården 1926.

Symphytum officinale. — *Redväg.* Kölaby: Trädets stn. Dalum: stn. Brunn: Brunnsnäs vid Åsunden (G), stn. — Fivlered: Karlskoga, Nabben (Rdb), Ramsberg, Sörgården. Kölingared: Hemryd, Ingared, Kölingsholm. Böne: Gamlegården, Storegården. Hössna: Hjortåsen, Lönnåsen, Önnarp. *Ås.* S. Vånga: Rosendal (vitblommig) (S). Hällstad: Brunstorp, Dannarp, kkn, prästgården (även vitblommig) (S), Påvagården. Fänneslunda: Sotared. S. Ving: Hökerum. Varnum: Väla. Rångedala: Bredared, Gretlanda. Äspered: Askanäs, kyrkbyn. Toarp: Målsryds stn (S), Stålarp.

S.* × *uplandicum. — *Redväg.* Dalum: Vinsarp. *Kind.* S. Åsarp: Limmared. *Ås.* Toarp: Målsryd (G).

Anchusa officinalis. — *Redväg.* N. Åsarp: Ekeberga. Kölaby: SO om Gärdet, utmed vägen till Solberga. Humla: S om kkn. Blidsberg: kkn. — Solberga: kkn. *Kind.* Marbäck: Bredgården, kkn.

A. arvensis. — T. allmän.

Pulmonaria officinalis ssp. ***obscura.*** — *Redväg.* Dalum (hb. G. A. Fröman, U). Timmele: Knuve. Brunn: Kråkeboberg (även vitblommig), Åsakullen. Ulricehamn (Rdb). — Knätte: backsluttning 400 m S om Lönnern. *Kind.* Tvärred: N om Tvärredslund. Dannike: Slätten (L). Marbäck: Korpebo, Kärrabo, Stensered. S. Säm: Klevaberget. *Ås.* Äspered: Dalshester (G), Sägryd (G).

P. angustifolia. — *Redväg.* N. Åsarp: Ekeberga, Frugården, pkt 222, 4, N om Åsen. Kölaby: Borred (moränkulle S om stn), Tummarp. Blidsberg: Björnarp (jvgn), Dalakvarn, Deragården (båda sidor om Ätran), Ö om folkskolan, Hallabo, Holmen (på ömse sidor om vägen till Hallabo), Kässeberg (baktrågen), vid Ätran på gränsen till Dalum. Dalum: Flatekvarn (brinkarna vid Ätran), Gustavsberg (jvgn), Krutbrännaregården [brinkarna (G) o. vid jvgn], Nydala, Nöresjön, Plate (brinkarna), Pålstorp, Silarpskullen, jvgn N om stn, Svenstorp (moränkulle vid Ätran o. vid gården), Vinsarp (L), Vång. Timmele: Kattåkra, Nöre (backsluttning i norra delen av byn o. i brinken mitt för Plate), Yttre Vång. — Knätte: moränkullen 500 m S om kkn (S). Hössna: Valared (G). *Kind.* Finnekumla: Sundet (Kj). *Ås.* Hällstad: Hof (N o. Ö om gården) (G, S). — Finnekumlalokalen har ej kunnat återfinnas. Antagligen föreligger en förväxling med *Pulmonaria officinalis* och dess förekomst i Tvärred: Tvärredslund (se ovan). — Karta (fig. 2).

Lappula myosotis. — *Redväg.* Ulricehamn (uppgiven av Naezén 1782, senast sedd av förf. på 1930-talet). *Ås.* S. Ving: Hökerums stn 1925. Toarp: Toarpsdals stn 1926.

Myosotis palustris. — Allmän.

M. laxa ssp. ***caespitosa.*** — Allmän.

M. silvatica. — *Redväg.* Dalum, Kölingared, Böne, Liared, Hössna: på och invid kyrkogårdarna. Eljest sedd vid: N. Åsarp: prästgården. Dalum: Vinsarp. Brunn: Kråkebo. — Böne: Lönnarp. Hössna: prästgården, Valareds kraftstn. Gullered: prästgården (Ndm). *Kind.* Länghem: Torpa. S. Säm: Attorp. *Ås.* Hällstad: Hof, kkn, prästgården. Grovare: Sjögården. Fänneslunda: herrgården, Karstorp. Härna: kkn. S. Ving: Hökerum, Nygården, Tångagärde. Tärby: kkn.

Rångedala: prästgården. Äspered: Hallabron, kkn. — Stadd i kraftig spridning.

M. arvensis. — Allmän.

M. hispida. — Allmän.

M. stricta. — Allmän.

M. discolor. — T. allmän.

Asperugo procumbens. — *Redväg.* N. Åsarp: Ekeberga (Rdb).

Cynoglossum amabile. — *Ås.* S. Ving: Hökerums stn 1935 (S & W).

Ajuga pyramidalis. — Allmän.

Teucrium scorodonia. — *Ås.* Toarp: Gånghester (jvgn 500 m S om stn) (S, S & W). Ej sedd efter de hårda vintrarna under början av 1940-talet.

Scutellaria galericulata. — T. allmän.

Nepeta cataria. — *Redväg.* Ulricehamn 1782. *Ås.* Varnum: Väla (S & S!).

Glechoma hederacea. — Allmän.

Dracocephalum ruyschiana. — *Redväg.* Smula: Kolbrandstorp, bron över Skråern, Stommen (moränkulle S om kkn), åsarna. N. Åsarp: Alvared (G), Brunnsgården, Skägga (moränkulle), Ågården, Åsarp Rättaregården. Kölaby: Borred, V om Danstorp, Gärdet 1860 (Rdb), Rynninge, Tummarp. Humla: 1,5 km N om kkn (moränkulle). Blidsberg: Brolyckan, Dalakvarn, Holmen (moränkulle V om Ätran o. N om vägen till Hallabo), kkn (brinken Ö om Ätran). Dalum: Flate, Krutbrännaregården, Plate, Silarpskullen (även vitblommig) (L), N om Vångs by, Ögården (röse 300 m V om gården). Timmele: Nöre, Älgåsen (G). — Knätte: kullarna 500 m S om kkn (S). Liared (L, S). Hössna: Hössnatorp (UB!). *Ås.* Hällstad: Gammalstorp (G), Knapagården (Rdb), Älmestad (G, S). Varnum: Bossgården (G). — Karta (fig. 2).

Prunella vulgaris. — Allmän.

Galeopsis ladanum. — *Redväg.* N. Åsarp: Frugården, stn, Åsarp Rättaregården. Kölaby: Gärdet, Kråkeberg, kullarna S om Sverkilstorp. Humla: utmed vägen mot Blidsberg. Blidsberg: Dalakvarn. Dalum: Rom, samhället, Vinsarp. Timmele: 6 lok. Vist: Ubbarp. Brunn: Röstesjön. Ulricehamn (G). — Solberga: kyrkbyn. Fivlered: kkn, Årred. Kölingared: Ingared. Knätte: kkn. Hössna: 4 lok. Gullered: Ekesbo, S om kkn, Sjögared. *Kind.* Marbäck: stn. Gällstad (Kj). Hillared: Hultet, Kärraholm, Lagsjön. S. Åsarp (Kj). Ljungsarp (id.). *Ås.* Kärråkra: kkn. Hällstad: Snugge. Grovare: Bergsgärde. Fänneslunda: herrgården, Hästhagen, kkn. Härna: Tåbol. S. Ving: 10 lok. Varnum: 7 lok. Rångedala: Klämmestorp. Äspered: Vatunga. Toarp: Häljared (G).

G. bifida. — Ej konsekvent antecknad. — *Redväg.* Blidsberg: vid kkn. *Ås.* Toarp: Gånghester.

G. tetrahit. — Allmän.

G. speciosa. — Allmän.

Lamium album. — *Redväg.* N. Åsarp: Åsarp Rättaregården. Vist: nya sopstn. Ulricehamn: stn. — Solberga: Väberga kvarn. Gullered: prästgården (Ndm). *Kind.* Tvärred: Hulud (S & W). Dannike: Boanäs,

kkn, Stenshult. Länghem: Djurgården, Forsa, Hovsnäs (S & W), kkn (G), Stommen (S & W), Torpa (id.). Marbäck: »norra delen» (Hård). Gällstad: Torsbo. Ljushult: Aplareds stn (S & S!). Sexdrega: Buttorp, Holmåkra, kkn, Ringestenavägen vid Hagalundsjön. *Ås.* Äspered: Sundholmen. Toarp: Bygd (G!), Målsryd (S & W).

L. purpureum. — Allmän.

L. hybridum. — *Redväg.* Vist: nya sopstn. *Kind.* Länghem: Torpa. *Ås.* S. Ving: prästgården. Äspered: kyrkbyn, Vatunga.

L. intermedium. — *Redväg.* N. Åsarp: (»Åsarp») (S). Blidsberg (Rdb). Dalum: Vinsarp. Vist: villastaden (ÖN). Ulricehamn. *Ås.* Äspered: Vatunga. Toarp: Horsåsen (G).

L. amplexicaule. — Allmän.

Leonurus cardiaca. — *Kind.* Marbäck: kkn (ÖN!). [*Ås.* Toarp: Bygd (G). Odlad o. förvildad?]

Stachys silvatica. — *Redväg.* Humla: ekbacke vid Ätran NO om kkn. Dalum: Vång. Timmele: Kattåkra, Knuve, Nöre, V om stn. Vist: Hössnavägen, Nyboholm, Vistberget. Brunn: Kråkeboberg, Åsakullen. Ulricehamn: Lindängen (Kj), Marbäcksvägen. — Kölingared: Valshalla, Årås. Knätte: Björkvik. Liared: Tuskan. Hössna: Lönnåsen. *Kind.* Tvärred: Alshammar. Dannike: Rölle, Stuvhult. Länghem: SV om Gäddviken, Kinnaliden, Torpa. Finnekumla: Fästered. Marbäck: Källebacka. S. Säm: Attorp, Klevaberget. Grönahög: Holmö skog (Ndm), Torsberg. Hillared: Tåstaberget vid Såken (Hpn). Sexdrega: Skogsgården. *Ås.* S. Ving: Bogakvarn, Mastunga (Källarnabben). Varnum: Årnäs. Rångedala: vid bäcken nedom Algutstorp. Äspered: Sundholmen, Vatunga. Toarp: mell. Fly mader o. Kärra (G), mell. Gånghester o. Hjortryd, N om Målsryd (i dalen), Sjögården, Skår (G).

S. palustris. — *Redväg.* Kölaby: Tåstarp. Dalum: Flate, S om Krutbrännaregården, N om kyrkbron, Vinsarpsjön. Timmele: Klockaregården, kyrkbron. Vist: nya sopstn. Brunn: Hede, Kråkeboberg. Ulricehamn: vid Åsunden. — Hössna: Önnarp. *Kind.* Tvärred: Alhammar. Finnekumla: Fästered. Marbäck: mell. stn o. tunneln. Sexdrega: Buttorp. Hulared: Reutersberg, Stålared. *Ås.* Möne: Berget. S. Ving: Lida, Mogden, Romsås, Tolken. Varnum: Bossgården (i Viskan). Äspered: Lövaskog, Vatunga. Toarp: Slätthult.

S. annua. — *Redväg.* Ulricehamn: stn 1931.

Satureja vulgaris. — *Redväg.* Humla: åsryggar vid Ätran NO om kkn. Blidsberg: Kässeberg. Dalum: kkn, Plate, Pålstorp, vid Silarpsbäcken, stn, Svenstorp (moränkulle vid Ätran), Vång. Timmele: Knuve. Vist: Vistberget. Brunn: Kråkeboberg, Kälkared, Tranegärde, Åsakullen. Ulricehamn (S). — Kölingared: Valshalla. Knätte: kullarna S om kkn. Liared: Tuskan (Ndm). Hössna: Önnarp. Gullered: Hultagärde (id.). *Kind.* Tvärred: Hjärtsbo, Högagärde. Dannike: Rölle. Finnekumla: Sundet. Marbäck: N om Björkered, kkn, Näsboholm, pkt 196, 4, nedom Sjö-Gunnarsbo. S. Säm: Attorp, Vegby. Hillared: Påtebo. *Ås.* S. Ving: Hökerum.

S. acinos. — *Redväg.* Smula: L. Fagerås, åsarna. N. Åsarp: Frugården, kkn, Långekra. Kölaby: kkn, Sverkilstorp, Trädets gård, mell.

Åsen o. pkt 221, 9. Humla: Drättekvarn, N om Torp, åsrygg vid Ätran NO om kkn. Blidsberg: 8 lok. Dalum: 12 lok. Timmele: Knuve, Kroken, Nygården, Nöre (byn o. i brinkarna). Vist: jvgn. Brunn: Brunnsnäs, Kråkeboberg, Röstesjön. — Solberga: åsryggen N o. S om kkn. Böne: Åfärd. Knätte: kring kkn, kullarna 500 m S om kkn. Liared: Holmåkra, S om kkn. Hössna: Björstorp, Valared (Ndm). Gullered: Ekesbo (id.). *Kind.* Länghem: Haldarp, Torpa (S). Finnekumla: Övrarp. Marbäck: jvgn vid Korpeboberg. *Ås.* Kärråkra: kkn. Hällstad: Hof. S. Ving: Romsås.

Origanum vulgare. — *Redväg.* Humla: åsryggar vid Ätran NO om kkn. Vist: Vistberget. Brunn: Kråkeboberg, Åsakullen. Ulricehamn 1782. — Knätte: kullarna 500 m S om kkn. *Kind.* S. Säm: Klevaberget. [*Ås.* Toarp: Bygd (G), Målsryds stn. Sannolikt odlad o. förvildad.]

[*Thymus pulegioides.* — *Ås.* Toarp: Bygd (G). — Odlad o. förvildad?]

Th. serpyllum. — Allmän.

Lycopus europaeus. — T. allmän.

Mentha gentilis v. ***anderssoniana.*** — *Kind.* Hillared: Gälared (G), mell. Olovshult o. Eriksberg (G). *Ås.* Äspered: Vatunga. Toarp: Kerstinsgärde (G), Målsryd (G, S), Nygården (G), Ryd (G, S), Skäftingsbacka (G). — Hylander 1941.

M. aquatica. — *Redväg.* Kölaby: Trädet (i Ätran) (TH). Humla: Smedsgården vid Ätran (det. C. Blom). *Ås.* Varnum: Ågårds kvarn (G).

M. aquatica × ***arvensis.*** — *Redväg.* Humla: Smedsgården vid Ätran. Blidsberg: Dalakvarn. Ulricehamn: Oset. *Kind.* Sexdrega: Billeberg vid Ätran. *Ås.* Murum: Lidan vid Skålarp. Varnum: Kvarnagården, Mellsjön, Ågården (S). Rångedala: Finnekumlasjön, Gravryd (S).

M. arvensis. — Allmän.

Atropa bella-donna. — *Redväg.* N. Åsarp: Holmestorp (fv.) (S).

Hyoscyamus niger. — *Redväg.* Humla: kkn (Hård). Blidsberg: vägkant i byn. Timmele: kkn. *Kind.* Marbäck: Bredgården (1 ex. 1953) (Sten Lindhagen). *Ås.* Kärråkra: kkn. S. Ving: Aspanäs 1937, kkn (S) (senast 1953).

Solanum dulcamara. — *Redväg.* N. Åsarp: 3 lok. Blidsberg: kkn, Kässeberg. Dalum: 5 lok. Timmele: 4 lok. Vist: Brogården (Slottet), Vistafors, Åsunden. Brunn: 4 lok. Ulricehamn: vid Åsunden o. Ätran. — Solberga: Baggekvarn. Kölingared: Årås. Böne: kkn (Kj). Liared: kvarnen vid kkn. Hössna: Önnarp. *Kind.* Tvärred: 4 lok. Länghem: Forsa. Finnekumla: Fästered. Marbäck: 5 lok. S. Säm: 4 lok. Gällstad: Bystad, Intorp. Hillared: Veka. Sexdrega: Buttorp, Kortö (GSn). S. Åsarp: ån vid kkn, Ladugården. *Ås.* Möne: Sjöarp. Fänneslunda: herrgården. Härna: prästgården. S. Ving: 5 lok. (vitblommig i Säbybäcken). Varnum: mell. sjöarna, vid Viskan, Årnäs. Rångedala: Rångedalaån vid stn. Äspered: Vatunga. Toarp: Kerstinsgärde, Målsryd.

S. nigrum. — *Redväg.* N. Åsarp: nära kkn (ÖN). Humla: Väddåkra (ÖN). Vist: vid kkn. *Kind.* Länghem: Haldarp (S & W). Hillared: Stomsbacken. Sexdrega: Buttorp, Kortö (GSn). *Ås.* Hällstad: prästgården. Härna: prästgården. S. Ving: 6 lok. Äspered: 3 lok. Toarp: Målsryd (Ldg). — På flertalet lokaler tillfällig.

Datura stramonium. — *Redväg.* Blidsberg: vid kkn 1931.

Verbascum phlomoides. — *Kind.* Finnekumla: Fästered 1 ex. 1943. *Ås.* Rångedala: Gretlanda (tidigare odlad).

V. thapsus. — *Redväg.* N. Åsarp: samhället. Kölaby: S om Gärdet. Blidsberg: brinkarna vid kkn. Dalum: Tingvalla, Vinsarp. Timmele: Gryteskog, kkn. Vist: vid landsvägen mell. Hössna o. Ulricehamn, kkn, nya sopstn, Vistberget (i rasmarken). Brunn: Kråkeboberg, V om kkn, Långsered. Ulricehamn: stn. — Böne: prästgården, Åfärd. Knätte: Gamlegården. Liared: Skeppsholmen. Hössna: Pinebo. *Kind.* Tvärred: Kronhult, Tvärredslund. Dannike: kkn, Stenshult. Länghem: SV om Gäddviken (GSn). Marbäck: dalgången mot Åsen. Gällstad: kkn, St. Bystad. Grönahög: kkn. Ljushult: Arnäsholm. Hillared: Gälared, bergsstup vid Såken. Sexdrega: Dalen (Tld), samhället. S. Åsarp: Limmared, Oppensten. *Ås.* Möne: kkn. Hällstad: Brunstorp, kkn, prästgården, Väby, Älmestad. Fänneslunda: Solberga. Härna: Nitta, prästgården. S. Ving: Bogakvarn, Hökerum, kkn, Tolkabro. Tärby: Ö om kkn. Varnum: kkn, mell. sjöarna, Väla. Rångedala: Klämmestorp. Äspered: Stommen, Sundholmen. Toarp: Bygd, kkn, vid Mellsåkern. — Säkerligen har arten på många ställen tidigare varit föremål för odling.

V. nigrum. — *Redväg.* Smula: 3 lok. N. Åsarp: 5 lok. Kölaby: 3 lok. Humla: Smedsgården, sluttningarna utmed Ätran. Blidsberg: Björnarp, kkn. Dalum: kkn, stn. Timmele: 6 lok. Vist: 3 lok. Brunn: 9 lok. Ulricehamn: stn, södra stadsdelen. — Solberga: kkn. Fivlered: Årred. Kölingared: Ingared, Åråsa. Böne: 3 lok. Knätte: kkn, kullarna S om kkn. Hössna: 3 lok. Gullered: kkn. Strängsered: stn. *Kind.* Tvärred: 3 lok. Länghem: 4 lok. Marbäck: 4 lok. S. Säm: Vegby, Ågården. Gällstad: kkn. Hillared: 4 lok. Månstad: kkn. Dalstorp: Boarp. S. Åsarp: Limmareds stn, Oppensten. Ljungsarp: kkn. *Ås.* Kärråkra: kkn. Hällstad: Brunstorp (TH), Hof, Sandslätt (TH). Grovare: 3 lok. Fänneslunda: kkn. Härna: 3 lok. S. Ving: 10 lok. Tärby: kkn. Varnum: Boarp (S), kkn, Årnäs. Rångedala: 4 lok. Äspered: 3 lok. Toarp: Dalsjöfors stn.

V. nigrum × thapsus. — *Redväg.* Timmele: Gryteskog 1925 (G, S). Brunn: Redvägsbrunns stn (vid sågen). *Ås.* Äspered: Vatunga.

V. phoeniceum. — *Ås.* Möne: Rävike 1925.

Linaria vulgaris. — T. allmän.

L. repens. — *Kind.* Sexdrega: Målek (Tld!). Dalstorp: Gundlabo (Kvl), Remmen (id.), ålderdomshemmet (id.). *Ås.* Grovare: Björkeberg (ödetomt) (G). S. Ving: Aspanäs (fv.). Varnum: stationsområdet (G).

Chaenorrhinum minus. — Vanlig längs jvgslinjerna med undantag för banlinjen Ulricehamn—Strängsered, där den är sällsynt. Tidigast sedd av A. O. Olson vid Toarp: Målsryd 1914 (B).

Scrophularia nodosa. — *Redväg.* N. Åsarp: 2 lok. Humla: NO om kkn. Blidsberg: 3 lok. Dalum: 5 lok. Timmele: 5 lok. Vist: 3 lok. Brunn: 6 lok. — Fivlered: kkn. Kölingared: 3 lok. Böne: Lönnarp. Knätte: 2 lok. Liared: 3 lok. Hössna: 3 lok. Gullered: 2 lok. Strängsered (Ndm). *Kind.* Tvärred: 4 lok. Dannike: 2 lok. Länghem: 5 lok. Finnekumla: 2 lok. Marbäck: 4 lok. S. Säm: 5 lok. Gällstad: Bystad.

Grönahög: 4 lok. Hillared: 4 lok. Sexdrega: 2 lok. Dalstorp: Boarp. S. Åsarp: 2 lok. *Ås.* Möne: Torkilstorp. Hällstad: 2 lok. Grovare: Avelsås. Härna: Tissås. S. Ving: 8 lok. Varnum: 3 lok. Rångedala: 2 lok. Äspered: 3 lok. Toarp: 2 lok.

Limosella aquatica. — *Redväg.* Timmele: kyrkbron (obekräftad skolpojksuppgift). Ulricehamn 1782. *Ås.* Toarp: Häljareds flogar 1889 (G).

Veronica longifolia. — *Redväg.* Smula: kkn. N. Åsarp: 6 lok. Kölaby: Lundby. Blidsberg: Danstorp. Dalum: 3 lok. Timmele: 7 lok. Vist: Ubbarp, Vistberget. Brunn: 4 lok. — Solberga: N om kkn. Kölingared: 3 lok. Böne: Hällunda, N om kkn. Knätte: kkn, kullarna S om kkn. Hössna: 3 lok. *Kind.* Tvärred: Tvärredslund. Länghem: Haldarp, Hovsnäs, Torpa. Finnekumla: Stockholmen. Marbäck: samhället, Storegården. S. Säm: 5 lok. Gällstad: Bystadsjön (Kj), Götåkra, prästgården. Grönahög: Nyarp (Kvl), Solstugebacken. Hillared: Läggared (Kj), Påtebo, Skedeskamma. Sexdrega: Billeberg, Dalen (Tld). Månstad: Björdal. Dalstorp: Boarp, Sånarp. S. Åsarp: Oppensten (G), Skårtebo. *Ås.* S. Vånga: Backabo. Kärråkra: kkn. Möne: kkn (TH), Rävike, Sjöarp, Tomten (TH). Hällstad: Brunstorp, kkn. Grovare: Ulvared. Fänneslunda: Karstorp. Härna: 3 lok. S. Ving: 14 lok. Varnum: 5 lok. Rångedala: 4 lok. Äspered: Vatunga. Toarp: Häljared, Skenstad.

V. longifolia* × *spicata. — *Veronica spicata* är ej sedd inom bygden, men däremot har jag påträffat en del övergångsformer till *longifolia* på sandjord i Ätradalen N om Åsunden. — *Redväg.* Dalum: Plate. Timmele: Knuve (jvgn), landsvägen S om kkn, Källebacka (jvgn).

V. serpyllifolia. — Allmän.

V. arvensis. — Allmän.

V. verna. — T. allmän i Ätradalen N om Åsunden. F. ö. sällsynt. — *Redväg.* N. Åsarp: Alvared, Frugården, Herrgården, utmed gla jvgsbanken i riktning mot Smula, Valunda, Åsen, Ögården. Kölaby: Trädets gård. Humla: Hulegården, på gränsen till Kölaby. Blidsberg: Dalakvarn. Dalum: Krutbrännaregården, Plate, Rom. Timmele: Annestorp, Kattåkra, Knuve, Nöre. Vist: Prången (ÖN), Stommen. Brunn: Kråkebo. — Kölingared: Kölingsholm. Knätte: kkn, Långsered. Liared: kkn. Hössna: N om kkn. Gullered: byn. *Kind.* Länghem: Haldarp. Marbäck: S om kkn. Sexdrega: gästgivaregården (G), stn. *Ås.* Kärråkra: kkn. Hällstad: kkn. S. Ving: Aspanäs, Romsås, Svederna, Tolkabro. Varnum: Boarp. Toarp: Bygd (G), Germundared (G), Målsryd (G).

V. polita. — *Ås.* S. Ving: prästgården 1926. Toarp: Målsryd (Ldg).

V. agrestis. — T. allmän.

V. persica. — *Redväg.* Vist: nya sopstn 1953. *Ås.* Murum: Rya. Hällstad: kkn (Bdg), prästgården (S). S. Ving: Kärr, Sjöbredared. Äspered: Hägnagärde.

V. hederifolia. — *Redväg.* Ulricehamn 1782. *Ås.* Äspered: Vatunga 1 ex. 1945.

V. chamaedrys. — Allmän.

V. scutellata. — T. allmän.

V. officinalis. — Allmän.

V. anagallis-aquatica. — *Redväg.* Kölaby (Hård). Humla: i Ätran vid Smedsgården. Dalum: Flatekvarn, Silarp. Timmele: bäcken S om banvaktsstugan, kyrkbron, bäcken S om Plate, Vång. Brunn: bäcken vid kkn. Ulricehamn 1782. — Solberga: Baggekvarn. Hössna: Valareds kraftstn, Önnarp (Ndm). *Kind.* Finnekumla: Fästered (Kj). S. Säm: Vegby (Bdg). *Ås.* Kärråkra: bäcken vid kkn o. Sjö. Murum: Skålarp i Lidan (TH). Hällstad: Gammalstorpsbäcken N om Salunda (S), bäck N om L. Björken. Fänneslunda: herrgården. S. Ving: Fäbroarna, Töve. Varnum: Kvarnagården, Ågården. Rångedala: Holmen. Äspered: Sjötorp.

V. beccabunga. — T. allmän.

Digitalis purpurea. — *Redväg.* Vist: Vistberget (Rdb!). Antagligen utsådd på slutet av 1800-talet och håller sig alltjämt kvar i rasmarken.

D. lutea. — *Redväg.* Timmele: Vång (1 ex. 1954).

Melampyrum cristatum. — *Ås.* Varnum: Kvarnagården.

M. arvense. — *Redväg.* Ulricehamn 1782. — Ej återfunnen.

M. pratense. — Allmän.

M. silvaticum. — Allmän.

Euphrasia rostkoviana ssp. ***montana.*** — *Redväg.* Timmele: Vång. Brunn: Hede, Kälkared (G).

E. rostkoviana ssp. ***pratensis.*** — *Kind.* S. Säm (ängsmark) (Kj).

E. brevipila ssp. ***tenuis.*** — *Redväg.* Blidsberg: Björnarp. Dalum: Plate, stn. Timmele: Lena, Sjöbacka. — Böne: Hyared. Knätte: Slätthult. *Kind.* Tvärred: Hjärtsbo, Hult. *Ås.* S. Vånga: Backabo. Möne: Tomten. Hällstad: Salunda. Grovare: Högagärde. S. Ving: Sjöbacka, Sjöslätt, Tolkabro (S), Öndared. Rångedala: Gravryd, Holmen. Toarp: L. Bygd (G), Skäftingsbacka (G).

E. brevipila ssp. ***eu-brevipila.*** — T. allmän.

E. curta. — T. allmän.

E. micrantha. — *Redväg.* N. Åsarp (Rdb). Vist: Vistberget. — Fivlered (Kj). *Kind.* Gällstad (Kj). *Ås.* Tärby: Intagan, Knallen.

Odontites rubra. — *Redväg.* Kölaby: Stommen. Dalum: Flate, Pålstorp. Timmele: 4 lok. Brunn: 4 lok. Ulricehamn 1782. — Solberga: kkn. Böne: Åfärd. Hössna: kkn, Sjöryd. Gullered: 5 lok. *Kind.* Länghem: Torpa. Finnekumla: herrgården. Marbäck: 3 lok. Hillared: Lagsjön. Sexdrega: Kortö (GSn). Dalstorp: Gundlabo (Kvl). Ljungsarp (Kj). *Ås.* Kärråkra: kkn. S. Vånga: Backabo, Åsen. Murum: Nygård. Hällstad: 5 lok. Fänneslunda: 3 lok. Härna: byn, Nitta. S. Ving: 7 lok. Varnum: 6 lok. Rångedala: Klämmestorp, kkn. Äspered: Vatunga. Toarp: Dalsjöfors stn, Gånghester, kkn.

Rhinanthus serotinus. — Allmän.

Rh. minor. — Allmän.

Pedicularis sceptrum-carolinum. — *Redväg.* N. Åsarp: prästgårdskärret (Lennart Fridén!). Dalum: vid Vinsarpsjön 1876 (G. A. Fröman, G, S, U). — Knätte: mossmark SO om Lunds by. Gullered: Karlabo (G), Skattegården (Ndm), Stommen (id.), Tryggängen (Bgt). *Ås.* Möne 1870 (S) (Rdb). Toarp: St. Bygd (Kilängen 1883 A. O. Olson) (G).

(Härutöver är arten i södra Västergötland blott funnen i Eriksbergs socken.) — Karta (fig. 6).

P. palustris ssp. ***eu-palustris***. — T. allmän.

P. palustris ssp. ***opsiantha***. — *Kind.* Länghem: S o. N om Dunsjön. Hulared: Grytteredsjön (G). *Ås.* Toarp: kärret nedom Slutes (G).

P. silvatica. — *Redväg.* N. Åsarp: N om Alvared. Kölaby: Sverkilstorp. Humla: Väddåkra. Dalum: 4 lok. Timmele: 4 lok. Vist: Härstorp. Brunn: Kälkared, Kättsered, Långsered. — Solberga: Baggekvarn. Kölingared: Valshalla, Åråsen (Kj). Knätte: Igelsered, kullarna 500 m S om kkn. Liared: 5 lok. Hössna: 3 lok. Gullered: 3 lok. Strängsered: St. Hästhagen, Torhult. *Kind.* Tvärred (Kj). Marbäck: Sjö-Gunnarsbo (Kj). S. Säm: Sandslätt, Vegby. Gällstad: Götåkra. Grönahög: Ingeshult, Köttekulla gärde, Nyarp. Ölsremma: Grebbaslätt. Hillared: Texlesjön. Sexdrega: Sandsjönäs, Skogsgården. S. Åsarp: Limmared (S), Sjörred. *Ås.* Möne: Berget. Murum: kkn. Hällstad: 4 lok. Grovare: N om Grosken. S. Ving: 6 lok. Rångedala: Gravryd, Stavared. Äspered: Hallabron, V om Harekulla, Sägryd. Toarp: Bråthult, Bygd (G), Germundared (G), Målsryd (S), Slätthult (G).

Lathraea squamaria. — *Redväg.* Timmele: Blankared. Vist: Hester. Brunn: Kråkeboberg, Åsakullen. Ulricehamn: 2 lok. (Kj). — Kölingared: Tången (Kj). Liared: Tuskan (Ndm). Hössna: Halla. *Kind.* Tvärred: Tvärredslund. Dannike: Rölle. Länghem: Kinnaliden (Hpn). Marbäck: Näsboholm (ÖN), Skottek, Stensered, SO om Storegården (UB). S. Säm: Klevaberget. Ljushult: Backa, Hökhult. Sexdrega: Handbynäs, Skogsgården. S. Åsarp: N om Ladugården. *Ås.* Fänneslunda: Kullatorp, Solberga. S. Ving: Getared, Hästhagen, Romsås, Tångagärde. Äspered: Hägnagärde. Toarp: Häljared, Nygårdsbäcken (G), Skår (G), Slätthult (G).

Pinguicula vulgaris. — *Redväg.* Smula: L. Fagerås. N. Åsarp: 5 lok. Kölaby: 6 lok. Humla: Drättekvarn, Haberget, Väddåkra. Blidsberg: Danstorp, Hallabo. Dalum: 6 lok. Timmele: 6 lok. Vist: 3 lok. Brunn: 4 lok. — Solberga: Baggekvarn. Fivlered: Loppås. Kölingared: Sandvik, Stensered, Valshalla. Böne: 4 lok. Knätte: 6 lok. Liared: 5 lok. Hössna: 5 lok. Gullered: 4 lok. Strängsered: 3 lok. *Kind.* Tvärred: Hult, Sjöbo. Dannike: Rölle. Länghem: Angsjön, Djurgården. Marbäck: 3 lok. S. Säm: Ramasjön. Gällstad: 5 lok. Grönahög: Komosse, Östentorp. Ölsremma: Grebbaslätt, Åremma. Hillared: 6 lok. Sexdrega: 6 lok. *Ås.* Kärråkra: kkn. S. Vånga: Åsen. Möne: Bolstorp, mossen S om kkn. Murum: Årred. Hällstad: 10 lok. S. Ving: 10 lok. Varnum: Dållebo. Rångedala: Gretlanda, S om Marsjön, Sjöbacka. Äspered: 5 lok. Toarp: Bråthult (Ldg), Bygd.

Utricularia vulgaris. — *Redväg.* Kölaby: Sverkilstorp. Humla: Ätran vid Sörtorpet. Dalum: Flatekvarn, Tingvallakärret, Viesjöns avloppsdike (S). Timmele: diket mell. Kroksjöarna o. Bredsjön (TH). Ulricehamn: gölen nedom Lindängen. — Knätte: kvarnen, kkn. Gullered: Ätran (Ndm). *Kind.* Tvärred: Dammsjön (Kj). Dannike: Boanäs. Länghem: N om Dunsjön (GSn). Finnekumla: Fästered (Kj). Gällstad: Påbo. Ljushult: Kärra. Sexdrega: Buttorp (Tld), Ätran

nedom stn (Hpn). *Ås.* Murum: Skålarp (TH). Hällstad: St. Björken (S). Härna: Gärdsjön. S. Ving: Kärr, Mogden vid Vätersholm, Säby. Varnum: Mellsjön (Bdg), stn. Toarp: Häljasjö (G).

U. intermedia. — *Redväg.* Dalum: Tingavallakärret, Viesjön, Vinsarp (Rdb). — Strängsered: Komosse (Old). *Kind.* Länghem: Angsjön, Borgasjön, S om Vassgården. Grönahög: Komosse (Old). Hillared: Hösjön, mosse S om Åsendal. Sexdrega: Ringsås (GSn), Ryasjö (Hpn), avar i Ätran (id.). *Ås.* Möne: Viesjön (TH). Hällstad: Hällstadmossen (S), Igelsjön (TH), L. Björken (TH), Lövåsen (Rökebo) (TH), kärr mell. Skattegården o. Älmestad (TH), Ömmern (TH). Härna: Lövdala. Varnum: Marsjön (Kj). Toarp: Dalsjöfors (G, S), Tjärnsjö (G).

U. minor. — *Redväg.* Dalum: Viesjön, Vinsarpsjön. — Strängsered: Komosse (Old). *Kind.* Dannike: Boanäs. Länghem: Måleksområdet. Gällstad: Boarp. Grönahög: Komosse (Old). Ljushult: Aplared (G, S). Hillared: Hösjön. Sexdrega: Buttorp, Långsjön, Ryasjön (Hpn), avar i Ätran (id.). Hulared: Grytteredsjön. *Ås.* Möne: Viesjön (TH). Hällstad: Hällstadmossen (S), Igelsjön (TH), L. Björken (TH), Ömmern (TH). S. Ving: Vätersholm. Toarp: Bygd, Häljasjö (G), Sjögårdssjön, Styckesjö (G), Tjärnsjö (S).

Plantago major. — Allmän.

P. media. — Allmän i Ätradalen N om Timmele. *Redväg.* Brunn: Hede. — Solberga: åsryggen vid kkn. Fivlered: kkn. Kölingared: Ingared, Marbohemmet. Böne: kkn, Redvägsborg. Knätte: kkn, kullarna 500 m S om kkn, Köpmantorp. Liared: kkn, Skeppsholmen, Ubbholmen. Hössna: Holmarp, Hyåsen, Valared. Gullered: Sjögared (Ndm). *Kind.* Länghem: Torpa. Finnekumla: kkn. Marbäck: Bredgården, Bäckagården. Gällstad: Berga (G), Bystad, Torsbo. Månstad: kkn. *Ås.* Kärråkra: kkn, Sjö. S. Vånga: 4 lok. Möne: Bolstorp, kkn. Murum: kkn, Kyrkeberg. Hällstad: 6 lok. Härna: N om kkn. S. Ving: Backen, Hästhagen, Hästskoslätt, kkn. Tärby: kkn. Varnum: 5 lok. Rångedala: nära Klutebygård (G), längs gla vägen till Varnum. Äspered: kkn, Tångagärdshage, Vatunga. Toarp: mossen N om Hallabron, Häljared, kkn (S!), Stommen (S).

P. lanceolata. — Allmän.

P. indica. — *Redväg.* Vist: nya sopstn (G).

Littorella uniflora. — *Redväg.* Dalum: Nöresjön, Viesjön (TH), Vinsarpsjön. Ulricehamn: Åsunden. — Kölingared: Jogen (Kj). Liared: Oset (Kj). Gullered: sjöstränder (Ndm). Strängsered: Strängseredsjön (Bdg, Ndm). *Kind.* Åsunden. Gällstad: Rånnavägsjön. Grönahög: St. Oxsjön. Ölsremma: Komosse (Old). Ljushult: Lysjön (G). Hillared: Såken. Dalstorp: Dalstorpsjön. Hulared: Grytteredsjön. *Ås.* Hällstad: Bredsjön. S. Ving: Mogden, Tolken. Äspered: Tolken (S). Toarp: Flughult, Häljared, Sjögårdssjön (Kj).

Sherardia arvensis. — *Redväg.* Ulricehamn (ÖN). *Kind.* Länghem: Haldarp.

Galium aparine. — *Redväg.* Blidsberg: Ö om kkn, stn. Dalum: Vång. Timmele: kvarnen vid kkn. Vist: nya sopstn. Brunn: Kråkebo.

Kind. Länghem: Torpa. S. Säm: Attorp, Vegby, Ågården. *Ås.* Hällstad (TH). S. Ving: Hökerum. Äspered: Vatunga. Toarp: Kovra (G).

G. Vaillantii. — *Redväg.* N. Åsarp (Kj). Dalum: Vinsarp. Vist: nya sopstn. Brunn: Kråkeboberg. — Kölingared: Årås (Kj). Knätte: Staxåsen. *Ås.* Härna: kkn. S. Ving: Hökerum, Tomta. Äspered: Sundholmen. Toarp: Bygd (G).

G. spurium. — *Kind.* Länghem: Haldarp (S) (S & W). *Ås.* S. Ving: Aspanäs 1937. Toarp: Bygd (G), Dalsjöfors (G).

G. uliginosum. — T. allmän.

G. trifidum. — *Redväg.* N. Åsarp: Valundasjön (N. Törnqvist). *Ås.* Grovare: Grosken (S).

G. palustre. — Allmän.

G. triandrum. — *Redväg.* Smula: Kolbrandstorp, L. Fagerås, »åsarna» (G) (Rdb). N. Åsarp: Hansagården (G).

G. odoratum. — *Redväg.* Brunn: Kråkeboberg, Åsakullen. Ulricehamn 1782. — Kölingared (G). *Kind.* Tvärred: Handvik (vägkant, fv.). Dannike: Rölle (GSn).

G. boreale. — Allmän.

G. pumilum ssp. ***vulgatum.*** — *Kind.* Hillared: Torsered (G, S).

G. hercynicum. — *Redväg.* Timmele: Brostorp, Gryteskog, Torvås. Brunn: Långsered. *Kind.* Tvärred: Handvik. Dannike: Backa, Boanäs, Ramsjön, Rölle, Stålåsen. S. Säm: Attorp (Kj). Ljushult: Dalen, Drösphult, kkn. Hillared: mell. Gälared o. Lockryd. Roasjö: Ö om Apelnässjön, nära kkn, St. Apelnäs. Sexdrega: 18 lok. Hulared: Lund. S. Åsarp: Ås. *Ås.* S. Vånga: mell. Vånga o. Årred. Möne: Berget. Hällstad: Brunstorp, Gisslarp (S), mell. Kärragärde o. Väby, Pjukarp vid skjutbanan, Väby. Härna: 6 lok. S. Ving: 9 lok. Tärby: Ljungelund. Varnum: 3 lok. Rångedala: 11 lok. Äspered: 8 lok. Toarp: 5 lok.

G. verum. — Allmän.

G. mollugo. — Allmän.

G. mollugo* × *verum. — *Kind.* Ljushult: Ö. Sävshult (G). Hillared: Torsered (S). *Ås.* Toarp: Germestorp (S), Gånghester (S), Målsryd (G).

Adoxa moschatellina. — *Redväg.* N. Åsarp: Alvared. Humla: åsryggar vid Ätran NO om kkn. Blidsberg: Brolyckan, Dalakvarn, Hallabo, Kässeberg. Dalum: Flate, dalen mell. kkn o. Vinsarp, Nöre, Plate, Vinsarp, Vång. Timmele: Annestorp, Knuve, Kroken, brinkarna vid kkn, Nöre. Vist: Brogården (Slottet), Hedegården, Ubbarp, Vistberget. Brunn: Brunnsnäs, Kråkeboberg, Kälkared, Åsakullen. Ulricehamn: Lindängen. — Kölingared: Ingared, Valshalla, Årås (parken). Böne: prästgården. Knätte: moränkulle S om kkn. Liared: Tuskan (Ndm). Hössna: Amurbacken, Hjortåsen. Gullered: Ekesbo, Karlabo. *Kind.* Tvärred: Hulud, Högagärde, Tvärredslund. Dannike: Rölle, Stuvhult. Länghem: Torpa. Finnekumla: Fästered, Lindevik, Sjörred, Sundet. Marbäck: Korpebo, Källebacka, Kärrabo. S. Säm: Attorp, Klevaberget, Vegby. Sexdrega: Björkås (GSn), Handbynäs, Skogsgården. Hulared: Stålared. S. Åsarp: Oppensten (G). *Ås.* Hällstad: Älmestad. Grovare: Sjögården. S. Ving: 10 lok. Varnum: Boarp, Dållebo, Kvarnagården.

Rångedala: Finnekumla, Gravryd, Klockaregården, Ormåsa. Äspered: Gullestorp, Ö om kkn, Lövaskog, Sundholmen, Vatunga. Toarp: S om Mellsåkern (Claes Grill).

Sambucus nigra. — *Redväg.* Kölaby: Gärdet. Vist: nya sopstn. — Liared: Skeppsholmen. — Förvildad.

S. racemosa. — *Redväg.* Kölaby: Borred. Dalum: Flate, kyrkbron, grustag vid Silarp, brinkarna nedom Silarp, stn, Vinsarp. Timmele: Nöre (brinkarna). Vist: villastaden. — Böne: Lönnarp. *Kind.* S. Säm: Attorp. Gällstad: Götåkra. Hillared: Veka. *Ås.* S. Ving: Aspanäs, Hökerum, Romsås, Sjöslätt, Svederna. Varnum: Mellsjön, Väla, Ågården. Äspered: Ö om kkn. Toarp: Germundared, Gånghester, Målsryd, Slätthult, stn.

Viburnum opulus. — *Redväg.* Kölaby: Danstorp. Humla: Nickabo, åsryggar vid Ätran. Blidsberg: Dalakvarn, Hallabo, Kässeberg. Dalum: 6 lok. Timmele: Alarp, Bjättlunda. Vist: Ubbared, Vistberget. Brunn: 6 lok. — Solberga: Baggekvarn. Kölingared: vid Lönnern. Böne: mell. kkn o. Åfärd. Knätte: Köpmantorp. Hössna: 6 lok. Gullered: Ekesbo. Strängsered: Flärred, Kimmarebo. *Kind.* Tvärred: 8 lok. Dannike: Rölle, Stålåsen. Länghem: Kinnaliden. Finnekumla: 4 lok. Marbäck: 6 lok. S. Säm: 3 lok. Gällstad: St. Bystad. Grönahög: Östentorp. Ljushult: Aplared, Gränd. Hillared: Åsalund. Sexdrega: 6 lok. Månstad: Rösered (Kj). Dalstorp: Boarp. S. Åsarp: Oppensten. *Ås.* S. Vånga: utmed vägen mot Årred. Möne: Rävike, Tomten. Hällstad: Hof, Kronogården. Fänneslunda: Solberga. S. Ving: 14 lok. Varnum: 4 lok. Rångedala: 8 lok. Äspered: 4 lok. Toarp: 6 lok.

Linnaea borealis. — *Redväg.* Humla: Väddåkra (ÖN). Blidsberg: St. Börsbo. Timmele: Bjättlunda. Vist: Härstorp. Brunn: Kråkebo, St. Ekered (ÖN). Ulricehamn: Föret, sanatorieskogen. — Solberga: N om Ingabo. Kölingared: Kölingsholm. Liared: Brännered. Hössna: Lönnåsen. Gullered: Borred (Ndm), Hattåsen (id.). Strängsered: Tomten (id.). *Kind.* Länghem: L. Haldarp. Marbäck: Enebacken, Korpebo. Ljushult: Gränd, Skanssjön. Hillared: Getabron, Göshult. Sexdrega: Hjärtared (Tld), Lorensberg (id.), Ringsås (GSn), vägen mot Roasjö (Hpn), Snärsbo (Tld). Dalstorp: Gundlabo (Kvl). Hulared: Reutersberg (Kvl). *Ås.* Hällstad: Brunstorp. Grovare. Fänneslunda: Sotared. Härna: Justinsberg, Sassarp. S. Ving: Aspanäs, Nollyckan, Slumsvik, Säby, torpet Vedermödan. Rångedala: Gretlanda. Äspered: Hägnagärde, mell. Vatunga o. kkn. Toarp: Bråthult (G), Granekärr.

Lonicera periclymenum. — *Redväg.* Ulricehamn 1782.

L. xylosteum. — *Redväg.* Humla: åsryggar vid Ätran NO om kkn. Blidsberg: Dalakvarn, Kässeberg (baktrågen). Dalum: brinkarna S om Flate, Krutbrännaregården. Timmele: Nöre. Vist: Vistberget. Brunn: Kråkeboberg, Åsakullen. Ulricehamn 1782. — Kölingared: Valshalla. Hössna: Hjortåsen. *Kind.* Tvärred: Alhammar. Länghem: Kinnaliden. Marbäck: Hyared, Korpeboberg, SV om Marbäcksviken, Storegården, dalgången S om Åsen. S. Säm: Klevaberget. Sexdrega: Lorensberg (Tld). *Ås.* Varnum: Kvarnagården. Rångedala: Gravryd.

Valeriana officinalis. — *Redväg.* Kölaby: Borred. Dalum: Vång.

Kind. Länghem: Hovsnäs, Torpa. Finnekumla: Sundet (ÖN). S. Säm: Vegby (Sämsjön). Hulared: Reutersberg (Kj). *Ås.* Toarp: Sjögårdssjön (Kj!).

V. sambucifolia (*excelsa*). — T. allmän.

Succisa pratensis. — Allmän.

Knautia arvensis. — Allmän.

Scabiosa columbaria. — *Redväg.* Smula: Kolbrandstorp, L. Fagerås. N. Åsarp: Långekra. Kölaby: Sverkilstorp, Trädets gård. Blidsberg: Dalakvarn, S om Deragården, kkn (brinkarna vid Ätran). Dalum: Krutbrännaregården, kkn, 200 m S om kyrkbron, pkt 174,2, Silarpskullen, Svenstorp, Tingvalla, Ögården. Ulricehamn 1782. — Jfr karta hos Albertson 1945.

Campanula cervicaria. — *Redväg.* Brunn: Kråkeboberg (Rdb). Ulricehamn 1782. — Se även Westfeldt 1947.

C. rapunculoides. — T. allmän.

C. trachelium. — *Redväg.* Humla: ekbacke NO om kkn. Blidsberg: Kässeberg (baktrågen). Dalum: Gustavsberg, Silarp, Vång. Timmele: Knuve. Vist: Ubbarp. Brunn: Kråkeboberg, Kälkared, Remma, Tranegärde, Åsakullen. Ulricehamn 1782. — Hössna: Halla, Hoddered (Ndm), Krokstorp, Sjöryd, Önnarp. Gullered: Hultagärde. *Kind.* Finnekumla: Fästered. Marbäck: Sjö-Gunnarsbo. S. Säm: Klevaberget. *Ås.* S. Ving: Sjöbredared, Tångagärde. Varnum: Boarp. Rångedala: Gravryd, Klockaregården. Äspered: Sundholmen, Vatunga. Toarp: Drared, Sjögården.

C. latifolia. — *Redväg.* Dalum: Silarp (fv. i trädgård), Vinsarp (fv. i trädgård). Vist: vid Hössnavägen. Brunn: Gäla, Kråkeboberg, Kättsered, Remma. — Kölingared: Valshalla. Hössna: Halla, Hjortåsen, Lönnåsen, Rönnåsen (Ndm). Strängsered: Kimmarebo. *Kind.* Tvärred: Alhammar, Hand, Hulud, Rude, Skog, Tvärredslund. Dannike: Rölle. Finnekumla: Fästered, Övrarp. Marbäck: banvaktsstugan (vitblommig), Källebacka, Kärrabo, Stensered, Åsundens stn. S. Säm: Attorp, Klevaberget. Grönahög: Åbjörntorp (Kvl!). Ljushult: Backa. *Ås.* Fänneslunda: Solberga. S. Ving: Björnkällan, Ekeslunda, Hästhagen, Hökerum (fv. i trädgård, vitblommig), Romsås, Tångagärde, Töve. Rångedala: Gravryd. Äspered: Hägnagärde, Sundholmen (S), Vatunga. Toarp: Sjögården.

C. rotundifolia. — Allmän.

C. persicifolia. — T. allmän. Ej sedd i: *Kind.* Ölsremma o. Ljungsarp.

C. patula. — *Redväg.* Brunn: Redvägsbrunns stn, St. Ekered (ÖN). *Kind.* Tvärred: Rude, S. Backa. Länghem: Djurgården, Haldarp, stn, Varred. Ljushult: Kärra. Hillared: Kila, kkn, Läggared (under många år), Torsered. Sexdrega: Billeberg (Tld), Buttorp (id.). Månstad (Kj). S. Åsarp: mell. kkn o. Limmared. *Ås.* Hällstad: Väby. S. Ving: Aspanäs, Bogakvarn, Ekeslunda, kkn, Nygården, Romsås, Senered. Varnum: stn. Rångedala: Bredared, Gretlanda. Äspered: Krusabacken, Vatunga (under många år). Toarp: Målsryd (200 m NO om kapellet) (Ldg), Råslätt 1915 (G), Skäftingsbacka 1911 (G). — Som regel tillfällig.

Jasione montana. — *Redväg.* Blidsberg: Björnarp, kkn. Dalum: NV om Ambjörnarp, Krutbrännaregården, kkn. Timmele: Kroken. Vist: Fotåsen, kkn, Prången, skolan, sågen, Ubbarp, Vistberget. Brunn: Brunnsnäs, Kråkeboberg. Ulricehamn (Rdb). — Knätte: moränkulle S om kkn. Liared: Skeppsholmen. Hössna: kkn, prästgården (Ndm). Gullered: Tissered. *Kind.* Marbäck: Bredgården. S. Säm: Vegby. Ljushult: Aplareds stn. Hillared: Hultet, stn. Roasjö: St. Apelnäs. Sexdrega: Billeberg, Buttorp, Frälsegården (Tld). *Ås.* S. Ving: Säby. Rångedala: Gravryd. Toarp: kkn, Råslätt (S).

Lobelia dortmanna. — *Redväg.* Kölaby: Yttern. Dalum: Nöresjön. Timmele: Röstesjön. Åsunden. — Kölingared: Brängen, Jogen, Vålleredsjön (Kj). Gullered o. Strängsered: Strängseredsjön. *Kind.* Länghem: Angsjön, Hökasjön. S. Säm: Sämsjön. Gällstad: Bystadsjön, Rånnavägsjön. Grönahög: St. Oxsjön. Ölsremma: Komosse (Old). Ljushult: Lysjön, Skanssjön (Ldg). Hillared: Hultet, Hösjön, Såken, Texlesjön. Sexdrega: Björsjön. Månstad: Tapplesjön. Hulared: Grytteredsjön. Ljungsarp: Lagmanshagasjön (Kj). *Ås.* Möne: Ömmern (S). Hällstad: Björkensjöarna (TH). S. Ving: Mogden, Tolken. Äspered: Tolken. Toarp: Sjögårdssjön.

Eupatorium cannabinum. — *Redväg.* N. Åsarp: Fingerkvarn. — Solberga: Baggekvarn, Väberga kvarn. *Kind.* S. Åsarp: bäcken vid kkn, vägdike S om kkn.

Solidago virgaurea. — Allmän.

S. canadensis. — *Redväg.* Vist: nya sopstn. Brunn: banan. Ulricehamn: stn. *Ås.* Varnum: vid Marsjön. Äspered: Vatunga. Toarp: Dalsjöfors vid fabriken, jvgn vid kkn.

Bellis perennis. — Odlad o. förvildad.

Erigeron annuum. — *Ås.* Äspered: Vatunga (Solvik) (G).

E. canadense. — *Redväg.* Ulricehamn: stn. *Kind.* S. Åsarp: Limmared (glasbruket o. stn).

E. acre. — *Redväg.* Smula: bron över Skråern. Kölaby: Gärdet. Humla: kring kkn. Blidsberg: jvgn N om stn. Dalum: kkn, stn. Timmele: Annestorp, Kattåkra, Knuve, Nygården. — Knätte: N om byn. *Kind.* Ljushult: Aplared. Hillared: kkn, stn, Torsered. Sexdrega: Hagalundsjön. *Ås.* Kärråkra: kkn, Sjö. Hällstad: Älmestad. Fänneslunda: Klinten. Härna: Björnsgården. S. Ving: Aspanäs, Backared, Kullen, Mogden, Röstekärr. Tärby: Finnekumlasjön. Varnum: mell. sjöarna (S). Rångedala: Gravryd, Nordhemmet. Toarp: Gånghester, kkn.

Filago arvensis. — *Redväg.* Ulricehamn 1782 (även sedd i senare tid enl. prov.läkare A. Söderbom). *Kind.* Sexdrega: grustaget vid bron Ö om kkn (Hpn!). *Ås.* Härna: landsvägen SV om Anksjön. Tärby: Finnekumlasjön. Varnum: mell. sjöarna.

F. minima. — *Redväg.* Ulricehamn (Hård).

Antennaria dioeca. — Allmän.

Gnaphalium silvaticum. — Allmän.

G. uliginosum. — Allmän.

Inula helenium. — *Kind.* Finnekumla: fv. vid herrgården.

Inula salicina. — *Redväg.* Smula: åsarna i byn. N. Åsarp: 200 m Ö om jvgsbron. Kölaby: Stommen (vid ån), äng S om Trädet. Blidsberg: SV om Påarp. Dalum: Björkestorp, jvgn mell. Rom o. stn, Silarp, Ögården. Timmele: Yttre Vång. — Kölingared: Ingared. Knätte: moränkulle 500 m S om kkn. Hössna: mell. Brunsered o. Önnarp, Krokstorp, prästgården (Ndm), Önnarp. *Ås.* Möne: Bengtsgården, Rävike, Östergården. Hällstad: Lunden. S. Ving: Töve (A. O. Olson). Rångedala: Falskog (Kj).

Rudbeckia hirta. — *Redväg.* Blidsberg: jvgsskärningen N om stn (ÖN).

Helianthus annuus* v. *silvestris. — *Ås.* S. Ving: Hökerums stn 1926.

Bidens tripartita. — *Redväg.* Kölaby: Trädets samhälle. Humla: Väddåkra. Dalum: Nöresjön. Timmele: Klockaregården, samhället. Vist: nya sopstn, Åsunden. Brunn: Kråkeboberg, Skogen, längs Åsunden. Ulricehamn. — Kölingared: Årås. *Kind.* Länghem: Torpa. Finnekumla: Fästered. Marbäck: Bredgården, Bäckagården, stn. S. Säm: Vegby. Gällstad: Bystadsjön (Kj), Sämsjön (Kj). Hillared: Lagsjön. *Ås.* Murum: Skålarp. Hällstad: Dannarp, Kronogården, prästgården (TH), Väby. Fänneslunda: herrgården, Klinten. Härna: Tissås. S. Ving: 10 lok. Tärby: Finnekumlasjön, kkn. Varnum: Kvarnagården, Nitta, sjöarna, Väla. Rångedala: Gravryd (B). Äspered: Sjötorp, Sundholmen. Toarp: Tummarp.

B. cernua. — *Redväg.* Smula: Breskekvarn. N. Åsarp: Åsarp Rättaregården. *Ås.* Hällstad: Dannarp.

Galinsoga parviflora. — *Redväg.* Vist: nya sopstn 1953 (G).

Anthemis tinctoria. — T. allmän.

A. arvensis. — Allmän.

A. cotula. — *Ås.* S. Ving: Hökerums stn 1925.

Achillea ptarmica. — Allmän.

A. millefolium. — Allmän.

Chrysanthemum parthenium. — *Redväg.* Dalum: stn 1953. Vist: nya sopstn. Ulricehamn: utfyllnad vid stn.

Ch. vulgare. — T. allmän i Ätradalen N om Åsunden samt i *Ås* härad, med avtagande frekvens söderut. — Östra *Redväg.* Solberga: Baggekvarn, korsvägen vid kkn o. getryggen söderöver. Kölingared: kkn. Hössna: Ekbacken. Gullered: kkn. *Kind.* Tvärred: Hagalund. Länghem: kkn. Marbäck: kkn, Sandlid, Sjö-Gunnarsbo, Skottek. S. Säm: Vegby. Gällstad: Borred, Långared. Sexdrega: Ö om Billeberg, Kortö (GSn). Månstad: Björdal. Hulared: kkn. S. Åsarp: kkn, Limmareds stn. Ljungsarp: 1 km Ö om kkn. *Ås.* Kärråkra: kkn. S. Vånga: Backabo, Jonstorp, Ubbås. Möne: Berget, kkn, Tomten. Murum: kkn, Skålarp, Årred. Hällstad: Dannarp, Gisslarp, Hof, kkn, Väby. Grovare: Hökaberg, Ulvared. Fänneslunda: herrgården. Härna: Jutagården, Åstorp. S. Ving: Bredaslätt, Fäbroarna, Hule, Hästhagen, Hökerum, kkn, Kärr, Romsås, Säby, Töve. Tärby: Segerstorp. Varnum: Brogården, Dållebo, Kvarnagården, Mellsjön, Nitta, stn. Rångedala: Byttorp, Gretlanda, kkn, stn. Äspered: Sundholmen, Vatunga. Toarp: Kerstinsgärde, Skenstad, Toarpsdal.

Ch. leucanthemum. — Allmän.

Ch. segetum. — *Redväg.* Kölaby: Trädets gård 1951. Vist: nya sopstn. Ulricehamn: stn 1941. *Kind.* Sexdrega: Kilen 1952, Ringsås 1953 (GSn).

Matricaria inodora. — Allmän.

M. chamomilla. — *Redväg.* Dalum: Silarp. *Ås.* S. Ving: Säby. Äspered: Vatunga.

M. matricarioides. — Allmän.

Artemisia campestris. — *Redväg.* Smula: åsarna i byn. N. Åsarp: Alvared, Långekra. Kölaby: Borred, Danstorp, Tummarp. Humla: Hulegården. Blidsberg: Brolyckan, Dalakvarn, Deragården, N om vägen mell. Hallabo o. Holmen, kkn (Ö om Ätran), Vimmerstad. Dalum: Krutbrännaregården, kkn, N o. S om kyrkbron, Plate, Silarpskullen, Svenstorp, Ögården. Timmele: banvaktsstugan, Nygården, Nöre, Timmele kvarn. Ulricehamn: stn. — Solberga: kkn. Knätte: kkn, kullarna 500 m S om kkn. Hössna: Hössnatorp, omkring kkn, Valared (Ndm). *Ås.* Kärråkra: kkn (åsryggen) (S).

A. vulgaris. — T. allmän.

A. absinthium. *Redväg.* Humla: Väddåkra (ÖN). Vist: nya sopstn. Ulricehamn: stn. *Ås.* Hällstad: Brunstorp. Varnum: Kvarnagården. Äspered: Gullestorp. Toarp: ålderdomshemmet.

Tussilago farfara. — Allmän.

Petasites hybridus. — *Redväg.* N. Åsarp: Ekeberga kvarn. Blidsberg: Björnarp, kkn. Timmele: Bjättlunda. Vist: vid Hössnavägen. Brunn: Långsered, Snipe. Ulricehamn: södra stadsdelen. — Kölingared: Hemryd, Kölingsholm. Knätte: Hällunda, Köpmantorp, Lunds by. *Kind.* Länghem: stn. Finnekumla: Sjörred. Marbäck: Bäckagården, Näsboholm, Slätten (vid vägen). Ljushult: Gamla Aplared. *Ås.* S. Vånga: Bosarp. Murum: Rya. Hällstad: Djupedal, Hof, Katthög, Kronogården, prästgården (inplanterad o. förvildad), Väby. Grovare: Sjögården. Härna: kyrkbyn, Sassarp, Tissås. S. Ving: Ekeslunda, Getared, Kärr, Lida, prästgården, Romsås, Slätthult, Säby, Töve. Rångedala: Finnekumla. Äspered: Gullestorp, Lövaskog. Toarp: Kulla (G), Slätthult, Taryd, Toarpsdal (vid bäcken).

Arnica montana. — Allmän.

Senecio vulgaris. — Allmän.

S. silvaticus. — T. allmän.

S. viscosus. — Endast sedd längs järnvägslinjerna i: *Redväg.* Blidsberg, Timmele, Brunn o. Ulricehamn. *Kind.* Marbäck, Ljushult, S. Åsarp, Nittorp. *Ås.* S. Ving, Varnum, Toarp.

S. vernalis. — *Kind.* Sexdrega: bron vid kkn (Hpn). *Ås.* Äspered: Vatunga.

S. jacobaea. — *Kind.* Gällstad: Torsbo (i trädgården). [*Ås.* S. Ving (Hård), avser följande art.]

S. aquaticus. — *Ås.* S. Ving: Säby (1 ex. 1922) (G).

Carlina vulgaris ssp. ***eu-vulgaris.*** — *Redväg.* N. Åsarp: heden S om kkn. *Kind.* Marbäck: Vackebacka (H. Helmrot). *Ås.* Tärby: vid Mell-

sjön. Varnum: Hultet, mell. sjöarna. Toarp: Målsryd (G), Tränghult (G, S).

Arctium lappa. — *Ås.* Rångedala (S).

A. minus. — T. allmän i övre Ätradalen o. i norra *Ås.* Sällsynt i skogsbygderna. — *Redväg.* Kölingared: Åråsa. Knätte: byn. *Kind.* Tvärred: Enebacken. Länghem: Haldarp, Torpa. Finnekumla: Sundet. Gällstad: Torsbo. Sexdrega (GSn). *Ås.* Varnum: Kvarnagården, stn, Stommen. Rångedala: prästgården (S). Äspered: Gullestorp.

A. vulgare. — *Ås.* Varnum 1909 (G).

A. tomentosum. — *Redväg.* Vist: nya sopstn. Ulricehamn: Lindängen, södra stadsdelen. *Kind.* S. Åsarp: Limmared (glasbruket). *Ås.* Varnum: Nitta såg 1915 (G). Rångedala: prästgården (S).

Saussurea alpina. — *Redväg.* Kölaby: Sverkilstorp (1887 N. P. Stenholm) (G). Dalum: Silarp (kärr SV om gården o. längs bäcken S om densamma) (S), strax V om stn, Svenstorp (sidlänt slåtteräng), Vinsarpskärret (på gränsen till Böne) (S), Vång (Lennart Gustafsson, B). Timmele: Gryteskog (S), Nilsagården, Redvägsborg (vägdike) (G). Vist (Rdb). Brunn: Långsered (mell. byn o. landsvägen). — Böne: Gamlegården (S om Vinsarpsjön), Ö om Hällunda (på två ställen), Marbohemmet (Ö om vägen) (Bdg), prästgården (Ö om vägen) (G). Knätte: Igelsered, V o. S om kkn, mossmark Ö om Lunds by, Långsered, Rosenlund, Stommens ägor vid en bäck från Lunds by (Ndm!). Liared: Ubbholmen (S om vägen). Hössna: Björkelund, Brunsered (G, S), mell. Brunsered o. Önnarp, Hule, Hössnatorp (strax Ö om vägskälet), Krokstorp (Ndm!), S om Oset, prästgården (Ndm!), Ryaskogen, skjutbanan (Ndm), Valareds kraftstn, mell. Önnarp o. Oset (G), S om Önnarp, Öv. Hule. Gullered: sluttningen från byn mot Nolsjön (S), Nordgården (Ndm!), Skattegården (S). *Ås.* Möne: komministerbostället (B), mosskanten nedom Östergården (S). Hällstad: sluttningen N om Hof, Lunden (mosskanten). — Härutöver är *Saussurea* i södra Västergötland blott funnen i Skölvene socken. Jfr Westfeldt 1927. — Karta (fig. 6).

Carduus crispus. — T. allmän.

Cirsium vulgare. — Allmän.

C. palustre. — Allmän.

C. heterophyllum. — T. allmän. Funnen i samtliga socknar men med avtagande frekvens söderut.

C. heterophyllum* × *oleraceum. — *Redväg.* Böne: Åfärd (vid kvarnen o. gla åfåran) (S). Hössna: Valareds kraftstn, mell. Önnarp o. Oset (G, S).

C. heterophyllum* × *palustre. — *Redväg.* Hössna: Valareds kraftstn, mell. Önnarp o. Oset (G). Gullered: SV om Nolsjön. *Ås.* Möne: mossen S om kkn. S. Ving: Aspanäs stn (G), Nygården (mossen Ö om gården). Äspered: Vatunga. Toarp: Häljared (vägdike) (S & S!), St. Bygd (G).

C. acaule. — *Redväg.* Smula: moränkullar omkring byn, längs vägen mell. byn o. L. Fagerås, kkn, åsrygg S om L. Fagerås, bron över Skråern. N. Åsarp: fuktäng N om kkn, Långekra, Åsarp Rättaregården, Ögården. Kölaby: Gärdet, Lundby backar (Bgt), Rynninge, Sverkilstorp, Trädets

gård, Tummarp. Humla: N om Haberget, Nickabo, Smedsgården. Blidsberg: Dalakvarn, Hallabo, vägskäl SV om Påarp. Dalum: Krutbrännaregården, Plate, Ögården. Timmele: Källeberg, Lena, mell. Nötekulla o. stn, Vång. — Solberga: vägkant V om byn. Kölingared: Ingared (vid gården o. i ängsmarken norrut), Torpa (Hugo Rehn). Böne: prästgården (Ndm), Åfärd. Knätte: vägkant N om byn. Hössna: Brunsered, Önnarp. *Kind.* Tvärred: SO om Rude. Finnekumla: N om herrgården. *Ås.* Möne: Berget, Östergården. Hällstad: Hof, kkn (S), sluttningen N om mossen (SV om folkskolan), Åsen, S om Älmestad. S. Ving: Hästskoslätt.

***C. acaule* × *oleraceum*.** — *Redväg.* Knätte: mossmarken N om byn (G).

***C. oleraceum*.** — *Redväg.* Böne: prästgården, Åfärd (vid kvarnen o. gla åfåran), Ätran N om Åfärd. Knätte: på mossmarkerna N om kvarnen samt utmed Ätran mell. kkn o. kvarnen. Hössna: Krokstorp, i bäckdalen mell. Oset o. Önnarp samt i alskogen S därom, Ryaskogen, Valared, vid bron V om Önnarp. *Ås.* S. Ving: jvgsskärningen (planterad på 1920-talet). Toarp: SV om Målsryds stn, rikl. (utplanterad av A. O. Olson). — Jfr Westfeldt 1939. — Karta (fig. 7).

***C. oleraceum* × *palustre*.** — *Redväg.* Hössna: mell. Oset o. Önnarp (S).

***C. arvense*.** — Allmän.

***Onopordum acanthium*.** — *Kind.* Sexdrega: stn 1912 (Tld).

***Serratula tinctoria*.** — *Redväg.* Dalum (B) (Rdb). — Även Nordholm uppger arten från Dalum. Den har emellertid ej återfunnits i senare tid.

***Centaurea jacea*.** — *Redväg.* Smula: 6 lok. N. Åsarp: 8 lok. Kölaby: 5 lok. Humla: Drättekvarn, Väddåkra. Blidsberg: 5 lok. Dalum: 5 lok. Timmele: 4 lok. Vist: Ubbarp. Brunn: 3 lok. — Solberga: N om kkn. Kölingared: Baggekulla, Marbohemmet. Böne: 5 lok. Knätte: 3 lok. Liared: Ubbholmen. Hössna: 3 lok. Strängsered: stn. *Kind.* Tvärred: 3 lok. Finnekumla: Åsundsholm. Marbäck: 4 lok. Gällstad: Hjortsbacka. Ljushult: Aplareds stn. Hillared: kkn, Påtebo. Sexdrega: Buttorp. Månstad: 3 lok. *Ås.* Hällstad: 5 lok. S. Ving: Haga, Hästhagen, Romsås. Rångedala: Dränggården, Hagen, Torsbo. Äspered: Tångagärdshage, Vatunga. Toarp: Målsryd, Sjögården, Skenstad.

***C. cyanus*.** — T. allmän i *Redväg* o. *Ås*, sällsynt i *Kind.*

***C. scabiosa*.** — *Redväg.* Smula: 6 lok. N. Åsarp: 14 lok. Kölaby: 4 lok. Humla: 4 lok. Blidsberg: 8 lok. Dalum: 9 lok. Timmele: 6 lok. Ulricehamn: stn. — Solberga: åsryggen N o. S om kkn. Fivlered: Ramsberg. Kölingared: Marbohemmet. Böne: 3 lok. Knätte: 4 lok. Liared: 4 lok. Hössna: 4 lok. Gullered: S om kkn, prästgården. *Kind.* Tvärred: Kalvshester. Dannike: Stålåsen. Marbäck: 6 lok. S. Säm: Vegby. S. Åsarp: Limmared. *Ås.* Kärråkra: kyrkbyn, Sjö. Möne: Sjöarp. Murum: Kyrkeberg, Skålarp. Hällstad: 4 lok. Grovare: Ulvared. Härna: byn. S. Ving: 11 lok. Varnum: 6 lok. Rångedala: Dränggården, stn. Äspered: Vatunga.

***Cichorium intybus*.** — *Redväg.* Ulricehamn: södra stadsdelen 1945. *Ås.* S. Ving: Aspanäs 1920.

Lapsana communis. — T. allmän.

Hypochoeris maculata. — T. allmän.

H. radicata. — *Kind.* Tvärred: mell. Brosered o. Ekåsen. Länghem: Haldarp, Kinnaliden, Tingarör (Kj). Ljushult: Aplareds stn, Dalen, backen Ö om kkn, S om Lysjön. Hillared: Gälared, Hultet, kkn, Långasjö (Hård). Roasjö: byn. Sexdrega: Hagalund, Kortö (GSn), Ledet, Picke. Månstad: Månstadkulle (Kj). *Ås.* S. Ving: Ekeslunda. Rångedala: Håkansgården. Äspered: Hägnagärde, kkn, Vatunga. Toarp: Dalsjöfors, Gånghester (vägkant), Häglared, Långhult (Bdg), Målsryd (G, S), Slätthult, Stålarp.

Leontodon hispidus. — *Redväg.* Smula: byn, åsarna. N. Åsarp: fuktäng N om kkn. Kölaby: kkn, Stommen. Blidsberg: 6 lok. Dalum: 12 lok. Timmele: Nöre, Redvägsborg, Vång. Brunn: Kråkeboberg, Kälkared. Ulricehamn: Lönnåsen. — Solberga: åsen N o. S om kkn. Kölingared: 6 lok. Böne: Hällunda, NO om kkn, Marbohemmet. Knätte: 5 lok. Liared: S om kkn. Hössna: 11 lok. Gullered: 4 lok. Strängsered: Flärred. *Kind.* Tvärred: Hjärtsbo, Hulud, Rude. Dannike: Rölle. Länghem: Kinnaliden. Marbäck: Korpebo, Storegården. Grönahög: Kvarnared. Ölsremma: Grebbaslätt. Hillared: stn (G). Sexdrega: Sandsjönäs. Dalstorp: Boarp. *Ås.* Kärråkra: kkn. Möne: Östergården. Murum: Rya. Hällstad: 4 lok. Fänneslunda: herrgården. S. Ving: 8 lok. Tärby: kkn. Varnum: Bossgården, Dållebo. Rångedala: Gravryd, Gretlanda. Äspered: Lövaskog, Vatunga. Toarp: Bygd (Toarpsängen) (G), Drared, Granelund.

L. autumnalis. — Allmän.

Tragopogon pratensis. — *Redväg.* Smula: bron över Skråern. N. Åsarp: 1 km N om stn. Blidsberg: Dalakvarn (vägkant), kkn. Dalum: Plate, stn. Timmele: stn. Vist: jvgn. Brunn: flerstädes vid jvgn. Ulricehamn: stn. — Solberga: åsen N o. S om kkn. Böne: Åfärd (grustag). Gullered: prästgården, Ubbared. *Kind.* Marbäck, Månstad o. S. Åsarp: längs jvgn. Gällstad: Torsbo. Hillared: stn. *Ås.* Möne: Bolstorp. S. Ving: Aspanäs o. Hökerum (jvgn). Varnum: stn. Rångedala: stn. Äspered: Vatunga (vägkant). Toarp: Dalsjöfors.

Scorzonera humilis.— T. allmän.

Sonchus arvensis. — Allmän.

S. oleraceus. — Allmän.

S. asper. — T. allmän.

Lactuca muralis. — *Redväg.* N. Åsarp: Fingerkvarn, Väberga kvarn, Åsen. Kölaby: Örsered. Humla: åsryggar vid Ätran. Blidsberg: kkn (Ö om Ätran), St. Börsbo, ullspinneriet. Dalum: Krutbrännaregården, S om kkn, Silarpsbäcken. Timmele: 5 lok. Vist: 4 lok. Brunn: 6 lok. Ulricehamn: 3 lok. — Solberga: Baggekvarn. Kölingared: 5 lok. Böne: Lönnarp. Knätte: Björkvik, byn. Liared: Oset. Hössna: Önnarp. *Kind.* Tvärred: 4 lok. Dannike: Fågelsången, Rölle. Länghem: Kinnaliden. Finnekumla: Fästered. Marbäck: 7 lok. S. Säm: 3 lok. Gällstad: St. Bystad, Torsbo. Grönahög: Torsberg. Ljushult: Aplareds stn, Kovra. Hillared: Gälared. Sexdrega: Björsjöberget. S. Åsarp: Oppensten. *Ås.* Möne: Torkilstorp. Hällstad: Sandslätt. Härna: Ank-

sjön. S. Ving: 7 lok. Tärby: Intagan, Ö om kkn, Marsjön. Varnum: Väla. Rångedala: Algutstorpsbäcken, S om kkn, stn, Torsbo. Äspered: Askanäs, Hallabron, Vatunga. Toarp: Andared, Berget, Gånghester, vid Mellsåkern, Målsryd.

Crepis biennis. — *Redväg.* Ulricehamn: Lindängen 1949. *Ås.* Toarp: L. Bygd (G).

C. capillaris. — *Redväg.* Vist: mejeriet. Ulricehamn. *Ås.* Äspered: Hägnagärde, Vatunga (Solvik). Toarp: Ekås skola (G, S), Germundared (G), Gånghester, Målsryd (G).

C. tectorum. — Allmän.

C. praemorsa. — Allmän i Ätradalen N om Åsunden. *Redväg.* Solberga: åsryggen vid kkn. Fivlered: kkn, Ramsberg. Kölingared: Baggekulla, Guldsmedshyttan, Hallebo, Marbohemmet, Söre, Torpa, Årås (Kj). Böne: Hyared, Hällunda, NV om kkn, Åfärd. Knätte: 10 lok. Liared: Bergabron, Gudebo, S om kkn, Skeppsholmen, Ubbholmen. Hössna: 10 lok. Gullered: Tissered. Strängsered: Flärred. *Kind.* Dannike: Rölle. Marbäck: Bäckagården, Kärrebo, pkt 196, 4. Gällstad: Götåkra, Intorp. Grönahög: Kvarnared. Ljushult: Sibbarp. Dalstorp: Boarp. *Ås.* Kärråkra. S. Vånga: Jonstorp, Östrabo. Möne: 8 lok. Murum: 4 lok. Hällstad: 12 lok. Grovare: Sjögården. Härna: 5 lok. S. Ving: 9 lok. Tärby: Bäckäng. Varnum: Nitta. Rångedala: Gravryd, Gretlanda, Hagen. Äspered: Vatunga. Toarp: Bygd (G), Häljared (S & S), Sjögården.

C. paludosa. — T. allmän.

Hieracium aurantiacum. — *Redväg.* Dalum: Vång. Vist: Härstorp. — Böne: S om Vinsarpsjön. Knätte: Gamlegården. Hössna: prästgården (Ndm). *Kind.* Ljushult: Dalen, kkn, tunneln V om stn. Hillared: stn. *Ås.* Möne: Bolstorp. Hällstad: prästgården (S), skolan, Älmestad. Grovare: Sjögården. Fänneslunda: Strömshov, vid landsvägen till Varnum. S. Ving: Aspanäs, Ekeslunda, Fäbroarna, Hökerum, Romsås, Tolkabro, Tångagärde. Varnum: Dållebo. Rångedala: stn. Äspered: Storegården.

Summary.

The flora of the north-eastern part of Sjuhäradsbygden, Västergötland, south-western Sweden.

The geographic position of the area investigated is shown in Fig. 1 (p. 651). The area measures about 2,000 km²; the underlying igneous rocks consist (mostly) of ferrugineous gneiss. The highest elevation is 358 m over sea-level. The suboceanic element is rather poorly represented in the flora of the area. *Teesdalia nudicaulis* and *Scirpus multicaulis* reach the area in its SW part only. *Quercus petraea* and *Galium hercynicum* are found in the central part of the area up to

lake Åsunden. *Narthecium ossifragum* has been observed in a few localities in the S and W, but occurs also in a limited area around the great bog district Komosse. *Erica tetralix*, *Littorella uniflora* and *Pedicularis silvatica* are more evenly distributed over the area.

The Silurian district of the central part of Västergötland (N of and closely neighbouring the area investigated) is characterized by the occurrence of a great number of distinctly continental and at the same time calciphilous species having in Scandinavia their general distribution in the S to SE. Several of these species also occur with gradually diminishing frequency in the northern part of the area down to the district around the lakes Tolken and Åsunden. The study of the distribution of these species was the main object of the present investigation. For some of them special distribution maps are given (cf., for instance, figs. 2 and 3). The areas of their distribution coincide with districts containing calcareous moraines and lacustrine clay.

The calciphilous representatives of northern species, such as *Pedicularis sceptrum-carolinum* and *Salix hastata*, have a distribution similar to that of the species mentioned above (see fig. 6). *Saussurea alpina* (fig. cit.) is not as distinctly calciphilous as the foregoing species. Its distribution in the S of Sweden is limited to the area investigated, with the exception of one locality in Småland and a few localities close to the northern boundaries of the area. Northern species of an oligotrophic character, such as *Betula nana* and *Carex livida*, gradually increase in frequency in the adjoining parts of Småland.

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AV

GÖSTA FÅHRÆUS och GÖRAN STENLID.

Älvkarleby socken i norra Uppland är sedan gammalt känd för sin rika växtvärld. Fanerogamfloran behandlades utförligt av Almquist i »Upplands vegetation och flora» (1929) och socknen är vad kärlväxterna beträffar en av de bäst utforskade i norra Uppland. Svampfloran är däremot föga undersökt om man undantager gastromyceterna. Lagerheim (1910) och Fries (1910) gjorde en del intressanta fynd i området kring Älvkarleön, och senare har Sandberg (1940) publicerat en ingående undersökning av Billuddens gastromycetflora.

Genom Sandbergs arbete kommo författarna till denna uppsats att intressera sig för svampfloran i Älvkarleby. De första exkursionerna gjordes 1945 till Billudden (för en allmän översikt av Billuddens natur se Sandberg 1948), och senare ha även övriga delar av socknen undersökts, ehuru ej så noggrannt som området kring Billudden och Brämsand. Sammanlagt ha ett 30-tal exkursioner gjorts och socknen har sedan 1945 besökts varje år utom 1947 som var ett exceptionellt dåligt svampår. Vidare har svampherbariet i Uppsala Universitets Botaniska museum genomgåtts, och allt där tillgängligt material från socknen har inarbetats i artförteckningen. Trots att stora luckor finnas i vår lista, kan den måhända ha sitt intresse då förteckningar över storsvampar uppgjorts endast för ett fåtal områden i vårt land. Åtskilliga släkten äro starkt underrepresenterade genom att vi icke lyckats att säkert bestämma det insamlade materialet, men vi hoppas kunna återkomma med kompletterande listor senare.

Älvkarleby socken upptager en areal av 230 km² och sträcker sig från 60°40′ (Billuddens norra spets) till 60°27′ (Björkö i Dalälven). Se kartan fig. 1. Topografien är mestadels flack och de

För publicering godkänd av rikets allmänna kartverk den 9 november 1954. Särtryck ur kartbladen 98 Gävle och 99 Lövsta. Generalstabens litografiska anstalt 1954.

Fig. 1. Karta över Älvkarleby socken (Map of Älvkarleby parish).
Numrerade lokaler (Numbered localities): 1. Storöbron, 2. Brämsand (härtill har räknats området från Dalälvens mynning till Billuddens bas), 3. Nabben, 4. Fårskär.

högsta punkterna ligga c:a 60 m över havet. Uppsalaåsens nordligaste del med åtföljande mäktiga sandlager passerar genom socknen, som i övrigt till största delen upptages av block- och moränmarker. Fast berg går endast på ett fåtal punkter i dagen. Myrmarker förekomma flerstädes, medan de egentliga sjöarna äro fåtaliga. Dalälvens nedre lopp utgör det viktigaste vattensystemet,

och ovanför Älvkarleöfallen har älven närmast karaktären av insjö.

Större delen av socknen är skogsmark, mestadels barrskog och blandskog. Vid Dalälven och på öar i densamma finnas dock lövskogspartier med riklig förekomst av ek. Den odlade jorden upptager c:a 50 km² eller drygt 20 % av arealen.

Årsnederbörden är i socknens södra del över 600 mm (se Wallén 1951), och området hör till de nederbördsrikaste i Uppland. Längs själva kusten är årssumman däremot låg och understiger 500 mm i den nordöstra delen. Skillnaden mellan olika delar av socknen är således avsevärd. Den särskilt längs kusten låga temperaturen under sommaren håller avdunstningen nere och humiditetstalet $\left(\frac{\text{årsnederbörd}}{\text{årsmedeltemp.} + 10}\right)$ ligger högre än i t. ex. trakten omkring Uppsala. Viktigt är vidare att de första höstfrosterna komma sent åtminstone längs själva kusten (se härom Sandberg 1940, som har en utförlig diskussion av klimat och jordmån på Billudden). Även Dalälven torde motverka avkylningen om hösten.

En för växtligheten viktig faktor är jordens höga halt av silurkalk, som sammanhänger med kambrosiluravlagringarna i Gävlebukten. Bland kärlväxterna finner man också en rad utpräglade kalkväxter (olika orkidéer, *Schoenus ferrugineus* m. fl., se närmare Almquist 1929).

Svampfloran uppvisar liksom kärlväxtfloran flera intressanta drag. Speciellt markens höga kalkhalt samt det relativt gynnsamma klimatet torde bidraga härtill. Liksom i fråga om kärlväxterna finner man många sydliga och kalkgynnade arter men därjämte en del nordliga element (jämför förekomsten av *Alnus incana*, *Equisetum scirpoides* och *Selaginella*!). Förekomsten av många sydliga arter har en indirekt orsak, nämligen att vissa svampar äro mer eller mindre strängt bundna till ek eller andra lövträd. Då eken här är nära sin nordgräns men likväl ställvis förekommer rikligt utgöra eksvamparna ett betydande inslag bland de sydliga arterna.

Då svamparnas utbredning är mycket ofullständigt känd, måste alla utbredningsuppgifter anföras med största försiktighet, men följande arter verka att vara representanter för några olika utbredningstyper:

Kalkgynnade arter.
(Calciphilous species.)

Cortinarius orichalceus
Craterellus clavatus
Boletus granulatus
Geaster fimbriatus m. fl.
Tulostoma brumale
Helvella crispa

Ekbundna arter.
(Species confined to oak.)

Mycena inclinata
Marasmius prasiosmus
Hypholoma sublateritium
Polyporus sulfureus
Hymenochaete rubiginosa
Stereum frustulatum
Daedalea quercina
Corticium commixtum
Phaeobulgaria inquinans

Nordliga arter.
(Northern species.)

Limacella illinita
Polyporus nigrolimitatus
P. roseus
Poria Stellae

Sydliga arter.
(Southern species.)

Utöver de arter som nämnts som kalkgynnade eller ekbundna kunna följande framhållas:

Amanita spissa (Andersson 1941)
Tricholoma irinum
T. sulfureum
Clitocybe geotropa
Collybia radicata
Mycena zephira
Marasmius Wynnei
Inocybe Bongardii
Cortinarius bolaris (Andersson 1940)
C. venetus
Lactarius pyrogalus
L. resimus
Boletus luridus (Andersson 1943)
Peniophora cinerea (Eriksson 1950)
P. pubera
Geaster triplex (Sandberg 1940)
Cyathus striatus (Sandberg 1940)
Scleroderma verrucosum
Cordyceps militaris (Andersson 1940)
C. ophioglossoides (Andersson 1942)

Flertalet av nedanstående arter äro antagligen också sydliga till sin utbredningstyp. Endast ett fåtal svenska lokaler äro kända för dem, varför de ej inordnats i någon grupp. (Rare species.)

Marasmius torquescens
Leucopaxillus rhodoleucus
Panus ringens
Lentinus omphalodes
Gyrodon lividus
Polyporus contiguus
P. Höhnelii
Poria terrestris
Clavaria himantia
Hydnum scabrosum
Stereum fasciatum
Bovistella echinella
Geaster minimus
Gautieria graveolens
Hysterangium clathroides
Sepultaria foliacea
Sowerbyella unicolor
Geopora Schackii

Vid bestämningsarbetet ha vi haft förmånen att få hjälp av experter, utan vilkas medverkan artlistan icke på långt när kunnat

bli så omfattande som den nu är. Fil. dr Seth Lundell har bestämt en stor del av materialet och konfirmerat många av våra egna bestämningar, och vi äro honom stor tack skyldiga för all hjälp han lämnat. Professor J. A. Nannfeldt har bestämt flertalet askomyceter och lämnat många värdefulla råd. Fil. lic. Gustaf Sandberg gav genom sina gastromycetstudier uppslaget till denna undersökning och han har dessutom givit oss många viktiga upplysningar om trakten och dess svampflora. I övrigt få vi tacka de personer som vid olika tillfällen åtföljt oss på exkursionerna. Särskilt vilja vi framhålla fil. lic. John Eriksson, som insamlat och bestämt ett rikt material av trädboende svampar. Hela detta material, som utgör en stor del av vår lista, har han ställt till vårt förfogande (en ringa del härav är publicerat, se Eriksson 1950 och 1954), och även beträffande övriga grupper har han varit till god hjälp.

År 1946 erhölls för dessa undersökningar ett resebidrag från Kungl. Vetenskapsakademien, för vilket vi härmed framföra ett vördsamt tack.

Nomenklaturen i nedanstående förteckning följer så långt det är möjligt Lundell & Nannfeldt, Fungi Suecici Exsiccati (auktorsbeteckningarna ha dock i regel förkortats).

För vanligare arter ha lokalerna icke förtecknats utan förekomsten har betecknats med »fl.» Detta är dock gjort endast om arten i fråga antecknats från minst tre lokaler belägna i olika delar av socknen samt iakttagits både i norra och södra delen. För vissa arter, som synts oss vara av särskilt intresse, ha lokaler angivits även om fynden äro ganska talrika.

Då fynden äro belagda i Uppsala Botaniska Museums svampherbarium anges detta efter fyndet med (U). För arter som betecknats med fl. innebär (U) att beläggexemplar finnas från en lokal i socknen. I övrigt ha följande förkortningar använts: J. E. = John Eriksson, S. L. = Seth Lundell, Nannf. = J. A. Nannfeldt, Sbg = Gustaf Sandberg.

Artförteckning

Hymenomycetes.

Amanita citrina Schaeff. ex Secr. — Fl.(U).
A. citrina Schaeff. ex Secr. var. *alba* (Pers.). — Billudden 9.9.45 (U).
A. muscaria (Fr.). — Fl.
A. muscaria (Fr.)* *regalis* (Fr.). — Fl.

A. porphyria (Fr.). — Fl.
A. rubescens (Fr.). — Fl.
A. spissa (Fr.). — Älvkarleön vid älven, 1 ex. 9.9.51.
A. virosa (Fr.). — Sågarbo 1.9.46.
Amanitopsis vaginata (Fr.) Roze. — Fl.
Limacella glioderma (Fr.) Maire. — SV om Sågarbo 9.9.45, Björkön 1 ex. 28.8.54, Brämsand 29.8.54.
L. guttata (Fr.) Konrad & Maubl. — Billudden 13.10.46.
L. illinita (Fr.) Murr. — Mellan Nabben och Förrådsberget 2.9.46, Billudden 13.10.46.
Lepiota acutesquamosa (Weinm.). — Billudden 30.9.45.
L. amianthina (Fr.). — Fl.
L. carcharias (Fr.). — Fl. (U).
L. clypeolaria (Fr.). — Sågarbo 9.9.45, mellan Nabben och Förrådsberget 2.9.46, Flat 26.8.51.
L. cristata (Fr.). — Fl.
L. excoriata (Fr.). — Sågarbo 9.9.45.
L. felina (Fr.). — Mellan Sågarbo och Nabben 2.9.46 (U).
L. granulosa (Fr.). — Fl.
L. procera (Fr.). — Fl.
L. rhacodes (Fr.). — Billudden 30.9.45 o. senare, Brämsand 24.9.50.
Armillaria focalis (Fr.). — Billudden NO om Billhamn 30.9.45, 20.10.49 (S.L. & Jens Stordal, U) och 23.9.50, vägen mellan Ytterboda och Sågarbo 23.9.50, Brämsand ymnigt 24.9. och 8.10.50, Marma skjutfält, S delen 25.9.49 (U).
A. mellea (Fr.). — Fl.
Tricholoma album (Fr.). — Fl.
T. amarum (Fr.) Quél. — S. om Gårdskär 4.11.45.
T. argyraceum (Fr.). — Billudden 30.9.45.
T. aurantium (Fr.). — Gårdskärs fiskehamn 3.9.50.
T. decorum (Fr.). — Karlsäter 25.9.49.
T. equestre (Fr.). — Fl.
T. flavobrunneum (Pers.). — Fl.
T. imbricatum (Fr.). — Fl. (U).
T. inamoenum (Fr.). — Fl.
T. irinum (Fr.). — Billudden 30.9.45 (U) och 24.9.50 (U), Älvkarleö V om stn 24.9.50.
T. lentum (H. v. Post ap. Romell). — Billudden 9.9.45 (U), Brämsand 24.9.50 (U).
T. luscinum (Fr.). — Billudden 30.9.45, 7.10.45 (Nannf. & Sbg, U), Brämsand 8.10.50.
T. melaleucum (Fr.). — Billudden 9.9.45, 7.10.45 (Nannf. & Sbg, U), 24.9.50, Sågarbo 30.9.45, S om Fårskär 23.9.54.
T. myomyces (Fr.). — Fl.
T. nudum (Fr.). — Fl.
T. pessundatum (Fr.). — Fl. (U).
T. portentosum (Fr.). — Båtfors 4.10.50.
T. rutilans (Fr.). — Fl.

T. saponaceum (Fr.). — Sågarbo 9.9.45 och senare, Storön 21.8.50 och senare.

T. sejunctum (Fr.). — Fl.

T. sordidum (Fr.). — Billudden på ängen vid Klyxen 9.9 och 30.9.45.

T. strictipes Karst. — Sågarbo 9.9.45.

T. sulfureum (Fr.). — Fl. (antecknad från 7 lokaler). Alltid i sällskap med hassel eller ek.

T. vaccinum (Fr.). — Fl. (U).

T. virgatum (Fr.). — Sågarbo 9.9.45, Storöbron 4.10.50.

Clitocybe Alexandri (Fr.). — Billudden fl. 1945—49 (U), Tensmyra vid älven 25.9.49 (U).

C. candicans (Fr.). — Tensmyra vid älven 25.9.49 (U).

C. clavipes (Fr.). — Sågarbo 30.9.45 o. senare.

C. connata (Fr.). — Sågarbo 30.9.45.

C. cyathiformis (Fr.). — Fl.

C. ditopoda (Fr.). — Nabben 2.9.46.

C. fragrans (Fr.). — Skogen 21.10.53.

C. geotropa (Fr.). — S om Fårskär 23.9.54.

C. gigantea (Fr.). — SV om Skutskär 26.8.51.

C. infundibuliformis (Fr.). — Fl.

C. inversa (Fr.). — Fl.

C. nebularis (Fr.). — Fl.

C. odora (Fr.) — Fl.

C. rhizophora (Vel.) Josserand. — Ytternäs (U) och Billudden 28.4.46.

Leucopaxillus rhodoleucus (Romell) Kühner. Billudden 30.9.45 o. senare (3 kollekter i U).

Laccaria laccata (Fr.). — Fl.

L. laccata (Fr.) var. *amethystina* Bolt. — Fl.

L. laccata (Fr.) var. *proxima* Boud. — Sågarbo 1.9.46.

Collybia acervata (Fr.). — Fl.

C. asema (Fr.). — Fl. (U).

C. butyracea (Fr.). — Sågarbo 1.9.46, Älvkarleön 9.9.51.

C. confluens (Fr.). — Fl.

C. dryophila (Fr.). — Fl.

C. esculenta (Fr.). — Fl. (U).

C. maculata (Fr.). — Fl.

C. platyphylla (Fr.). — Fl.

C. radicata (Fr.). — Billudden 30.9.45 o. senare.

C. rancida (Fr.). — V om landsvägen N om Tensmyra 23.9.50 (U), Storöbron 4.10.50.

C. tuberosa (Fr.). — Sågarbo 30.9.45 o. senare.

C. velutipes (Fr.). — Brämsand 20.11.49.

Marasmius androsaceus Fr. — Fl.

M. chordalis Fr. — Brämsand 2.9.46, Nabben 2.9.46 (U), Gårdskärs fiskehamn 14.9.49.

M. epiphyllus Fr. — Fl.

M. fulvobulbillosus Rob. Fr. — Fl.

M. oreades Fr. — Fl.

M. perforans Fr. — Fl.
M. peronatus Fr. — Fl.
M. prasiosmus Fr. — Nära Storöbron, 3 närbelägna lokaler på båda sidor om gränsen till Gästrikland 21.10.53; på ekförna (U).
M. putillus Fr. — Billudden vid vägen 20.11.49.
M. ramealis Fr. — Fl. (U).
M. rotula Fr. — Billudden vid insjön 22.7.45, Brämsand 2.9.46, vid Trösken 26.8.51.
M. scorodonius Fr. — Fl.
M. torquescens Quél. (=*M. tupuletorum* (Weinm.) Fr.) — Nabben 2.9.46 (U), S om Gårdskär 4.9.46 (U), Brämsand 13.10.46 (U), S om Fårskär 23.9.54.
M. Wynnei Berk. & Br. ap. Berk. — Billudden vid insjön 9.9.45 och senare (U), Brämsand 30.9.45 (Sbg, U) och 29.9.46 (Sbg, U), S om Fårskär 23.9.54.
Mycena alcalina (Fr.) Quél. — Brämsand 30.9.45, mellan Nabben och Förrådsberget 2.9.46.
M. cinerella Karst. — Billudden vid vägen 20.11.49 och senare.
M. corticola (Fr.). — Billudden 26.10.52.
M. elegans (Fr.). — Billudden vid vägen 20.11.49, Överboda 23.9.50, Fårskär 26.10.52.
M. epipterygia (Fr.). — Fl.
M. flavo-alba (Fr.). — Nabben 2.9.46.
M. galericulata (Fr.). — Fl.
M. galopoda (Fr.). — Fl.
M. haematopoda (Fr.). — Billudden vid insjön 9.9.45 o. senare, Mararna N om Fårskär 29.6.49.
M. inclinata (Fr.). — Storön på kullfallen ek 21.8.49.
M. lactea (Fr.). — Sågarbo 30.9.45, Fårskär 4.9.46.
M. leptocephala (Fr.). — Fl.
M. metata (Fr.). — Fl.
M. polygramma (Fr.). — Fl.
M. pura (Fr.). — Fl.
M. rosella (Fr.). — Fl.
M. rubromarginata (Fr.) Quél. — Sågarbo 30.9.45 o senare, Storöbron 21.10.53.
M. sanguinolenta (Fr.). — Storön 21.8.49, Flat 26.8.51.
M. viscosa Maire. — Sågarbo 13.10.46.
M. vulgaris (Fr.). — Fl.
M. zephira (Fr.). — Billudden 7.10.45 (Nannf. & Sbg, U) o. senare, S om Fårskär 23.9.54.
Omphalia campanella (Fr.). — Sågarbo 22.7.45 o. senare, Billudden 29.6.49.
O. ericetorum (Fr.). — Nabben 14.9.49.
O. fibula (Fr.). — Överboda 23.9.50.
O. maura (Fr.). — NV om Ambricka 14.10.53.
O. philonotis (Fr.). — Bölsjön 21.8.52.
O. pyxidata (Fr.). — Brämsand 30.9.45 o. senare.

O. scyphoides (Fr.). — Trösken 26.8.51.

Pleurotus acerosus (Fr.) — Billudden SV om insjön, på murken ved 20.10.49 (E. Åberg, U).

P. mitis (Fr.). — Storöbron på tall 21.10.53.

P. nidulans (Fr.). — Fl. (U).

P. pulmonarius (Fr.). — Skutskär 26.8.51.

P. serotinus (Fr.). — Fl. (U).

Panus ringens Fr. — Billudden vid insjön, på hägg, 20.11.49 (J. E. m. fl., U).

P. torulosus Fr. — Sågarbo 9.9.45, S om Gårdskär 4.11.45, Fårskär 4.9.46.

Lentinus omphalodes Fr. — SV om Skutskär 26.8.51.

L. ursinus Fr. — Sågarbo 9.9.45 (U), Fårskär på gran 4.9.46, Gårdskärs fiskehamn på lövved 3.9.50 (U).

Pluteus cervinus (Fr.) — Fl.

P. nanus (Fr.). — Sågarbo 30.9.45.

P. salicinus (Fr.). — Billudden nära insjön 13.9.49.

Entoloma clypeatum (Fr.) — Fårskär 23.9.54.

E. nidorosum (Fr.). — Fl.

E. rhodopolium (Fr.). — Sågarbo 9.9.45, Storöbron 4.10.50.

Leptonia euchroa (Fr.). — S om Fårskär 23.9.54.

L. serrulata (Fr.). — Billudden 9.9.45 o. senare.

Nolanea papillata Bres. — Billudden vid Klyxen 13.9.49.

Eccilia undata (Fr.). — Brämsand 3.9.46 o. senare, mellan Sågarbo o. Långasand 14.9.49.

Clitopilus prunulus (Fr.) Quél. — Fl.

Cortinarius alboviolaceus Fr. — Sågarbo 9.9.45 o. senare.

C. anomalus Fr. — Fl.

C. argutus Fr. — Brämsand 24.9.50.

C. armeniacus Fr. — Fl.

C. armillatus Fr. — Fl.

C. bivelus Fr. — Sågarbo 9.9.45, N om Muren 23.9.50.

C. bolaris Fr. — Sågarbo 9.9.45.

C. brunneus Fr. — Billudden 30.9.45.

C. callisteus Fr. — Sågarbo 9.9.45.

C. calochrous Fr. — Billudden 30.9.45 o. 24.9.50, Brämsand 24.9.50.

C. camphoratus Fr. — Fl.

C. cinnamomeus Fr. — Fl.

C. collinitus Fr. — Sågarbo 25.9.49.

C. cylindripes Kauffm. — Sågarbo 9.9.45 o. senare.

C. delibutus Fr. — Sågarbo 30.9.45 o. senare.

C. elatior Fr. — Sågarbo 9.9.45 o. senare, Fårskär 4.9.46.

C. elegantior Fr. — Ytterboda 23.9.50, Brämsand 24.9.50.

C. flexipes Fr. — Sågarbo 9.9.45.

C. gentilis Fr. — Sågarbo 9.9.45, Karlsäter 25.9.49, Marma 25.9.49 o. senare.

C. glaucopus Fr. — Fl.

C. infractus Fr. — Fl.

C. laniger Fr. — Överboda o. Ytterboda 23.9.50, Brämsand 24.9.50.
C. malachius Fr. — Marma 25.9.49, Tensmyra 25.9.49.
C. mucosus Bull. — N om Muren 23.9.50.
C. multiformis Fr. — Billudden 30.9.45, Marma 25.9.45, Brämsand 8.10.50.
C. orichalceus Fr. — Billudden och Brämsandstrakten fl., antecknad vid nästan varje besök 30.9.45 och senare, Gårdskärs fiskehamn 14.9.49 och 3.9.50. Den typiska formen har en tydlig anislukt. Luktlösa men i övrigt likartade former ha antecknats flera gånger; dessa fynd ha ej medtagits ovan.
C. papulosus Fr. — Brämsand 24.9.50.
C. percomis Fr. — Fl.
C. pholideus Fr. — Tensmyra 25.9.49.
C. prasinus Fr. — Brämsand 14.9.49, Båtfors 4.10.50.
C. sanguineus Fr. — Fl.
C. semisanguineus (Fr.) Gill. — Fl.
C. traganus Fr. — Fl.
C. turmalis Fr. — Sågarbo 9.9.45.
C. varius Fr. — Billudden och Brämsand 9.9.45 o. senare, Gårdskärs fiskehamn 14.9.49 o. senare.
C. venetus Fr. — Fl.
C. vibratilis Fr. — Sågarbo 9.9.45, Ytterboda och Överboda 23.9.50.
C. violaceus Fr. — Brämsand 9.9.51.
Pholiota caperata (Fr.). — Fl.
P. marginata (Fr.). — Fl. (U).
P. mutabilis (Fr.). — Fl.
P. squarrosa (Fr.). — Fl.
Inocybe Bongardii (Weinm.). — Tröskens Ö sida 26.8.51.
I. fastigiata (Fr.). — Sågarbo 30.9.45 o. senare.
I. geophylla (Fr.) f. *typica*. — Fl.
I. geophylla (Fr.) f. *pileo lilacino*. — Fl.
I. hirsuta (Lasch). — Fårskär 4.9.46.
I. lacera (Fr.) — Karlsäter 25.9.49, Marma skjutfält S delen 3.10.50 (U).
I. lanuginosa (Bull.). — Fårskär 4.9.46.
I. praetervisa Quél. — Brämsand 3.9.46, Storön 21.8.49.
Hebeloma crustuliniforme (Bull.) Fr. — Gårdskärs fiskehamn 14.9.49, SV om Skutskär 26.8.51.
H. mesophaeum (Fr.). — Billudden 7.10.45 (Nannf. & Sbg, U) och 16.5.48 (K. Aschan, U), Gårdskärs fiskehamn 14.9.49, Fårskär 26.10.52.
H. sacchariolens Quél. — Storöbron 4.10.50.
Flammula Agardhii (Lund) Fr. — Brämsand 13.10.46.
F. astragalina (Fr.). — Sågarbo 9.9.45.
F. carbonaria (Fr.). — Fl. på brandfläckar.
F. lenta (Fr.) — Fl.
F. sapinea (Fr.). — Fl.
F. picrea (Fr.). — Sågarbo 9.9.45 o. senare, Nabben 2.9.46.
F. scamba (Fr.). — S om Gårdskär 4.9.46.
F. spumosa (Fr.). — Ytterboda 23.9.50.

Naucoria erinaceus (Fr.). — Lanforsen på älvens Ö sida 25.9.49 (U), Billudden vid insjön 20.11.49.

N. escharoides (Fr.). — Fl. (U).

Galera hypnorum (Fr.). — Storön 21.8.49, Nabben 14.9.49.

G. tenera (Fr.). — Sågarbo 14.9.49.

Crepidotus calolepis (Fr.). — S om Fårskär 23.9.54, Storöbron 11.10.54. På asp.

Bolbitius vitellinus (Fr.). — Nabben 14.9.49, Marma skjutfält 25.9.49.

Paxillus atrotomentosus (Fr.). — Fl.

P. involutus Fr. — Fl.

P. panuoides Fr. — S om Gårdskär vid vägen till Holmsånger, på granstock, 4.11.45.

Psalliota abruptibulba Peck. — N om Muren 23.9.50 (U).

P. exquisita Witt. — Brämsand 25.9.50 (U).

P. semota (Fr.) (affin.). — Överboda 23.9.50 (U).

Stropharia aeruginosa (Fr.). — Fl.

S. Hornemannii (Fr.). — Fl.

S. semiglobata (Fr.). — Fl.

Hypholoma Candollianum (Fr.). — Brämsand och Billudden 13.9.49, Nabben 14.9.49, Gårdskärs fiskehamn 14.9.49.

H. capnoides (Fr.). — Fl.

H. fasciculare (Fr.). — Fl.

H. sublateritium (Fr.). — Storöbron, på ekstubbar, 4.10.50.

Psilocybe spadicea (Fr.). — Sågarbo, vid basen av en alm, 26.9.46.

Panaeolus acuminatus (Fr.). — Mellan Sågarbo och Långasand, 14.9.49.

P. Linnaeanus Imai. — Brämsand och Billudden 13.9.49.

Psathyrella disseminata (Fr.). — V om Älvkarleö jvstn 24.9.50.

Coprinus atramentarius Fr. — Sågarbo 26.9.46, Nabben 14.9.49.

C. Boudierii Quél. — Sågarbo, Nabben, Gårdskärs fiskehamn 14.9.49.

C. comatus Fr. — Fl. längs Uppsala—Gävle-vägen.

C. haemerobius Fr. — Brämsand 24.9.50.

C. micaceus Fr. — Karlsäter 23.9.54.

C. niveus Fr. — Mellan Sågarbo och Långasand 14.9.49.

Gomphidius glutinosus Fr. — Fl.

G. roseus (Fr.) Gill. — Marma vid skjutfältet 25.9.49 (U), Ytterboda 23.9.50.

G. rutilus (Fr.). — Fl.

Hygrophorus agathosmus Fr. — Fl.

H. camarophyllus Fr. — Östanå 9.9.45, Fårskär 4.9.46.

H. cantharellus Fr. — Billudden vid Klyxen 13.9.49.

H. chlorophanus Fr. — Billudden och Sågarbo 1.9.46.

H. citrinus Rea. — Billudden vid Klyxen 13.9.49. Överensstämmer med Langes beskrivning.

H. coccineus Fr. — Fl.

H. conicus Fr. — Fl.

H. cossus Fr. — Fl.

H. discoideus Fr. — Brämsand 26.9.46 (U) och 8.10.50 (U).

H. eburneus Fr. — Sågarbo 9.9.45.

H. erubescens Fr. — Fl.
H. hypothejus Fr. — Fl.
H. nigrescens Quél. — Nabben 2.9.46, Billudden vid Klyxen 13.9.49.
H. niveus Fr. — Billudden vid Klyxen 13.9.49, S om Fårskär 23.9.54.
H. olivaceo-albus Fr. — Sågarbo 9.9.45 o. senare.
H. pratensis Fr. — Fl.
H. psittacinus Fr. — Fl.
H. puniceus Fr. — Fl.
H. pustulatus Fr. — Sågarbo 30.9.45, Storöbron 4.10.50.
H. Reai Maire. — Billudden vid Klyxen 13.9.49.
H. russo-coriaceus Berk. & Br. — Brämsand 8.10.50 (U).
H. virgineus Fr. — Fl.
Lactarius cimicarius (Batsch) Massee. — Storöbron 4.10.50, S om Fårskär 23.9.54.
L. deliciosus Fr. — Fl.
L. flexuosus Fr. — Karlsäter 25.9.49.
L. glyciosmus Fr. — Fl.
L. helvus Fr. — Fl.
L. ichoratus Batsch. — Överboda 23.9.50.
L. insulsus Fr. — Karlsäter 23.9.54.
L. mitissimus Fr. — Fl.
L. necator Fr. — Sågarbo 2.9.46, Fårskär 4.9.46 o. senare, Gårdskärs fiskehamn 3.9.50.
L. obnubilus Fr. — Billudden vid insjön 3.9.46.
L. pyrogalus Fr. — Sågarbo 9.9.45, Fårskär 4.9.46, Älvkarleön 24.9.50, S om Fårskär 23.9.54. Alltid under hassel.
L. repraesentaneus Britzelmayr. — Storön 21.8.49.
L. resimus Fr. — Sågarbo 9.9.45 (U), Björkön 28.8.54.
L. rufus Fr. — Fl.
L. scrobiculatus Fr. — Fl.
L. subdulcis Fr. — Gårdskärs fiskehamn 14.10.53.
L. torminosus Fr. — Fl.
L. trivialis Fr. — Sågarbo 9.9.45 o. senare.
L. vietus Fr. — Tensmyra vid älvbrinken 25.9.49.
Russula adusta (Pers.) Fr. — Billudden 9.9.45 o. senare.
R. aeruginea Lindbl. ap. Fr. — Nabben 2.9.46, Tensmyra 25.9.49.
R. chamaeleontina Fr. — Överboda 23.9.50, Billudden 24.9.50.
R. decolorans Fr. — Fl.
R. delica Fr. — Fårskär 4.9.46.
R. flava Lönnegr. ex Romell. — Skutskär 14.8.32 (S.L., U).
R. foetens Fr. — Storön S om Hyttön 4.10.50, Karl XIII:s bro 29.8.54.
R. fragilis Fr. — Sågarbo 2.9.46.
R. integra Fr. — Nabben 2.9.46.
R. nigricans Fr. — Sågarbo 9.9.45.
R. Quéletii Fr. ap. Quél. — Fl. (U).
R. versicolor J. Schäff. — Ytterboda 23.9.50.
R. vinosa Lindblad. — Karlsäter 25.9.49, Överboda 23.9.50 (U).
R. xerampelina Fr. — Sågarbo 20.11.49.

R. xerampelina Fr. f. *olivascens* Fr. — Tensmyra 25.9.49 (U).

Cantharellus albidus Fr. — Nabben 2.9.46, Billudden vid vägen nära insjön 24.9.50 (U).

C. aurantiacus Fr. — Fl.

C. cibarius Fr. — Fl.

C. tubaeformis Fr. — Fl.

C. umbonatus Fr. — Fl. (U).

Leptotus muscigenus (Fr.) Lundell. — Billudden vid Billhamn 13.9.49 (U), 24.9.50.

Craterellus clavatus Fr. — Sågarbo 30.9.45 o. senare, mellan Nabben och Förrådsberget 2.9.46, Fårskärstrakten fl. 4.9.46 och senare, Storön 21.8.49, mellan Skutskär och Trösken fl. 26.8.51.

C. cornucopioides (Fr.) Pers. — Sågarbo 30.9.45, S om Fårskär 23.9.54.

C. lutescens Fr. — Fl.

Boletus badius Fr. — Fl.

B. bovinus Fr. — Fl.

B. edulis Fr. — Fl.

B. felleus Fr. — Skutskär 14.8.32 (S.L., U), Sågarbo 22.7.45 o. senare, mellan Nabben och Förrådsberget 2.9.46.

B. granulatus Fr. — Fl.

B. Grevillei Klotzsch [=*B. elegans* (Schum.) Fr.]. — Sågarbo 9.9.45, Älvkarleö bruk 21.8.49 o. senare. Under lärk.

B. luridus Fr. — Mellan jvstn och Älvkarleö bruk aug. 1910 (Lagerheim 1910), Älvkarleön vid älven 9.9.51, Flat vid vägen 26.8.51.

B. luteus Fr. — Fl.

B. piperatus Fr. — Fl.

B. scaber Fr. — Fl.

B. subtomentosus Fr. — Fl.

B. variegatus Fr. — Fl.

B. versipellis Fr. — Fl.

Gyrodon lividus (Fr.) Sacc. — Långasand 9.9.45 (U), S om Gårdskär 4.11.45, Nabben 14.9.49, Gårdskärs fiskehamn 3.9.50, S om Fårskär 23.9.54. Under al vid havsstränder.

Ganoderma applanatum Pat. — Fl. (U).

Polyporus abietinus Fr. — Fl.

P. adustus Fr. — Fl. (U).

P. amorphus Fr. — Fl. (U).

P. annosus Fr. — Brämsand på granstubbe 11.10.54.

P. arcularius Fr. — Billudden och Sågarbo 30.9.45, S om Gårdskär 4.11.45 (U).

P. benzoinus Fr. — Fl. (3 kollekter från Billudden i U).

P. betulinus Fr. — Fl.

P. borealis Fr. — Brämsand på gran 9.9.45.

P. brumalis Fr. — SV om Fårskärs sjöbodar på björk 10.7.44 (Nannf., U), Billudden 29.6.49, SV om Skutskär 26.8.51.

P. caesius Fr. — Fl.

P. conchatus Fr. — S om Gårdskär på sälg 4.11.45 (U), Billudden på sälg 20.11.49.

P. confluens Fr. — Fl.

P. contiguus Fr. — Billudden c. 300 m NV om Billhamn 20.10.49 (S.L. & J.E., U) och 20.11.49 (J.E., U) Ö om insjön 20.11.49 (J.E., U). På havtorn.

P. dichrous Fr. — S om Gårdskär på björk 4.11.45 (U).

P. elegans Fr. — S om Gårdskär 4.11.45, Storöbron 11.10.54.

P. erubescens Fr. — Billudden intill Brämsand på gran 29.9.46 (Sbg, U).

P. ferruginosus Fr. — Billudden vid insjön på murken alved 16.10.49 (J.E., U).

P. floriformis Quél. ap. Bres. — Billudden 7.10.45 (Nannf., N. Fries, Sbg, U).

P. fomentarius Fr. — Brämsand på björk 3.9.29 (Sbg) och senare.

P. fragilis Fr. — Storöbron 11.10.54.

P. Hoehnelii Bres. ap. v. Höhn. — Billudden vid insjön på al 30.9. 45 (U).

P. igniarius Fr. — Fl.

P. lacteus Fr. — Storöbron på fallen björk 11.10.54.

P. laevigatus Fr. — Storöbron på björk 11.10.54.

P. leucomelas (Fr.) Pers. — Gårdskärs fiskehamn 3.9.50 (U).

P. Lowei Pilát. — Billudden 7.10.45 (N. Fries, Sbg, Nannf., U).

P. melanopus Fr. — S om Fårskär 23.9.54.

P. nigrolimitatus Romell. — Storöbron på tallstock 11.10.54 (U).

P. obliquus Fr. f. *abortivus*. — Storöbron på björk 11.10.54.

P. ovinus Fr. — Fl.

P. perennis Fr. — Fl.

P. pinicola Fr. — Fl. (U). På gran, björk och gråal.

P. populinus Fr. — Fl. (U). På lönn och alm.

P. pubescens Fr. — Billudden på häggstubbe 21.8.29 (Sbg), Storöbron på asp 11.10.54.

P. punctatus Fr. — Billudden vid insjön på vindfälld rötad stam av rönn 20.10.49 (S.L. & J.E., U), V om Billhamn på delvis levande rönnstam 20.11.49 (J.E., U), Storöbron på sälg 11.10.54, Brämsand på hägg 11.10.54.

P. radiatus Fr. — Fl. (3 kollekter i U).

P. robustus (Karst.) f. *hippophaës* Donk. — Billudden 19.9.44 (Sbg, U) o. senare, Ö om Nabben 29.8.54, S om Fårskär 23.9.54. På havtorn.

P. roseus Fr. — Billudden, på gran, 3.9.29 (Sbg, U), Storöbron på granstock 11.10.54.

P. rutilans Fr. — Billudden vid Billskaten på rönn 13.10.46.

P. semisupinus Berk. & Curt. — Billudden vid insjön på död liggande alstam 20.10.49 (S.L. & J.E., U).

P. sericeo-mollis Romell. — Storöbron på barrvedsstock 11.10.54 (U).

P. stipticus Fr. — Fl. (U).

P. sulfureus Fr. — Fl. i området Älvkarleö—Storö—Björkö på levande och döda ekar 4.6.49 och senare.

P. tomentosus Fr. — Fl. (U).

P. varius Fr. — Björkön, på ek, 28.8.54.

P. versiporus Pers. (= *Irpex obliquus* Fr.). — Storöbron 11.10.54.

P. vulpinus Fr. — Storöbron på asp (årsgamla ex.) 11.10.54.

P. zonatus Fr. — Fl.

Poria aneirina (Sommerf.) Sacc. — Billudden vid insjön 13.10.46.

P. byssina Pers. — Billudden vid insjön 16.10.49 (J. E., U).

P. candidissima (Schw.) Cke. — Billudden vid insjön på murken alved 20.10.49 (S. L. & J. E., U), Brämsand på barrved 11.10.54 (U).

P. cinerascens (Bres. ap. Strass.) Bres. — Storöbron 11.10.54.

P. eupora (Karst.) Cke. — Billudden vid insjön på liggande alstam 20.10.49 (S. L. & J. E., U), Storöbron på sälg 11.10.54.

P. lenis (Karst. ap. Rbh.) Sacc. — Billudden vid insjön på murken lövved 20.10.49 (S. L. & J. E., U), Gårdskärs fiskehamn på fallen gran 14.10.53, Brämsand på gran 11.10.54 (U).

P. purpurea (Fr.) Cke. — Billudden vid insjön på murken alved 16.10. 49 (J. E., U).

P. Stellae Pilát. — Ö om Gårdskärs fiskehamn på gran vid havsstranden 14.10.53. Storöbron på tallstock 11.10.54 (U).

P. subincarnata (Peck) Murrill. — Storöbron på tall 11.10.54 (U).

P. terrestris (Fr.) Sacc. — Billudden strax N om Billhamn på grus under tallstubbe 20.10.49 (S. L. & J. E., U).

P. vaporaria (Fr.) Bres. — Fl.

Trametes abietis Karst. — Fl. (U). På gran.

T. albo-carneo-gilvida (Romell) Lundell. — V om Marma på en ö Dalälven på gammal ek 15.3.42 (S. Ahlner, U).

T. cinnabarina Fr. — S om Gårdskär 4.11.45, Brämsand 9.9.51.

T. heteromorpha (Fr.) Bres. ap. Neuman. — Sågarbo 9.9.45 o. senare. Långasand 30.9.45 (U), S om Gårdskär 4.9.46.

T. mollis Fr. — Fl. På rönn och asp.

T. odorata Fr. — Brämsand 2.9.46 o. senare, S om Fårskär 23.9.54.

T. pini Fr. — Billudden 26.8.29 (Sbg, U), Brämsand 13.10.46 o. senare, Storöbron 4.10.50. På tall.

T. serialis Fr. — Fl. (U).

Daedalea quercina Fr. — Björkön på ekstubbe 28.8.54.

D. unicolor Fr. — Sågarbo 30.9.45.

Lenzites betulina Fr. — Fl.

L. saepiaria Fr. — Fl.

Merulius corium Fr. — S om Gårdskär på al 4.11.45.

M. niveus Fr. — Brämsand på al 13.10.46 (U) o. senare, Billudden vid insjön på al 20.10.49 (S. L. & J. E., U) samt vid vägen nära insjön på gråal och måbär 20.11.49 (J. E., U).

M. serpens Fr. — Storöbron 11.10.54.

M. tignicola L. Harms. — Storöbron på resterna av gammal koja 11.10. 54 (U). Denna art är nybeskriven (Harmsen 1952) men är redan funnen på talrika lokaler i Danmark.

M. tremellosus Fr. — Billudden vid insjön på liggande murken alstam 16.10.49 (S. L. & J. E., U), Gårdskärs fiskehamn 14.10.53.

Hydnum aurantiacum Fr. — Fl. (U).

H. auriscalpium Fr. — Sågarbo 9.9.45 o. senare, Nabben 2.9.46, Gårdskärs fiskehamn 14.9.49.

H. coeruleum (Fr.) Pers. — Billudden 9.9.45.

H. corrugatum Fr. — Karlsäter på björkstubbe 25.9.49 (U).

H. ferrugineum Fr. — Fl.

H. ferrugineum Fr. var *scrobiculatum* (Fr.) — Fl. längs norra kusten (3 kollekter i U).

H. fuligineo-album Fr. — Långören Ö om Gårdskär 27.8.50.

H. imbricatum Fr. — Fl. (U).

H. melaleucum Fr. — Fl. (2 kollekter i U).

H. mirabile Fr. — Tröskens Ö ände 26.8.51.

H. nigrum Fr. — Fl. längs norra kusten (5 kollekter i U).

H. repandum Fr. — Fl.

H. rufescens Fr. — Sågarbo 9.9.45 o. senare, Storön 21.8.49.

H. scabrosum Fr. — Mellan Ytterboda och Sågarbo 9.9.45 (U) och 23.9.50 (U), Brämsand rikligt 24.9.50 (nr 2205 i Fungi suec. exs.).

H. strigosum Sw. — Brämsand på undersidan av murken alstam 26.9. 46 (U).

H. suaveolens Fr. — Laxön aug. 1910 (Lagerheim 1910), Gårdskärs fiskehamn 3.9.50 (U).

H. subsquamosum Batsch sensu Bres. — Långören Ö om Gårdskär 27.8.50 (U). Diskussion av identiteten i U.

H. tomentosum Fr. — Fl. (3 kollekter i U).

H. violascens Fr. — Fl. (3 kollekter i U).

H. zonatum Fr. — Billudden nära insjön 13.9.49 (U), Marma 25.9. 49 (U).

Irpex lacteus Fr. — S om Gårdskär 4.11.45.

Radulum Radula (Fr.) Nannf. — Billudden på rönn 15.8.29 (Sbg), Sågarbo 13.10.46, Storöbron på björk 21.10.53.

Phlebia albida v. Post ap. Fr. — Storöbron 11.10.54.

P. radiata Fr. — Fl.

Grandinia nivea (Fr.) Lll. — Billudden fl. på alved, barrved och havtorn (S. L. & J. E., 4 kollekter i U), Björkön på ek 28.8. 54, Brämsand på gran 11.10.54 (U).

Mycoacia fuscoatra (Fr.) Donk. — Billudden vid insjön på nedfallen algren 20.10.49 (S. L. & J. E., U).

Odontia arguta (Fr.) Quél. — Billudden vid insjön på murken alved 16.10. och 20.10.49 (S. L. & J. E., U), Överboda på ekstubbe 29.8.54.

O. bicolor (Fr.) Quél. — Storöbron på gran 11.10.54 (U), Brämsand på lövved 11.10.54 (U).

O. breviseta (Karst.) J. Erikss. ap. Lll & Nannf. — Billudden vid insjön på murken ved på marken 16.10.49 (J. E., U).

O. crustosa (Fr.) Quél. — Billudden N om Billhamn på kvarsittande torra havtornskvistar 20.10.49 (S. L. & J. E., U), Brämsand på murken gren på marken 20.11.49 (J. E., U), nära Karl XIII:s bro 29.8.54.

Mycoleptodon fimbriatus (Fr.) Bourd. & Galz. — Sågarbo på almgrenar 13.10.46, Älvkarleö bruk 11.10.54.

M. ochraceus (Fr.) Pat. — Björkön på rönnpinnar 28.8.54 (U).

Sistotrema Brinkmannii (Bres.) J. Erikss. — Billudden V om Billhamn på drivved på stranden och Ö om insjön på död havtornsstam i

strandsnår, Brämsand på död *Stereum rugosum* på al och på död ung sälgstam (forma) (alla 20.11.49, J. E., U).

S. commune J. Erikss. — Billudden vid insjön på död gren av *Lonicera xylosteum* 20.11.49 (J. E., U). Se vidare Eriksson 1949.

S. confluens Fr. — Fl. (U).

S. variecolor Bourd. & Galz. — Storöbron på ek 21.10.53 (U).

Clavaria abietina Fr. — Brämsand 13.9.49 (U).

C. Bourdotii Bres. — Billudden vid insjön på algren på marken 16.10.49 (J. E., U).

C. corniculata Fr. — Skogen 4.10.50, S om Fårskär 23.9.54.

C. cristata Fr. — Fl. (2 kollekter i U).

C. dendroidea O. Rob. Fr. ap. Fr. — Mellan Ytterboda och Brämsand i mossrik granskog 27.9.46 (R. Santesson, U).

C. fistulosa Fr. — Billudden vid insjön 13.10.46 o. senare (3 kollekter i U), Skogen 21.10.53.

C. flava Fr. — Sågarbo 9.9.45 o. senare.

C. gracilis Fr. — Billudden vid Klyxen 1.9.46 och 13.9.49 (U).

C. himantia (Schw.) Bourd. & Galz. — Billudden strax N om Billhamn på död en 20.10.49 (S. L. & J. E., U), nära insjön på undersidan av murken en 20.11.49 (J. E. m. fl., U).

C. inaequalis Fr. — Fl.

C. Krombholzii Fr. — Skogen 21.10.53.

C. ligula Fr. — Fl. (U).

C. ochraceo-virens Jungh. — Billudden och trakten av Brämsand fl. (5 kollekter i U).

C. pistillaris Fr. — Fl.

C. stricta Fr. var. *condensata* (Fr.) Lundell. — Billudden vid insjön 9.9.45.

C. suecica Fr. — Billudden och trakten däromkring fl. (5 kollekter i U), N om Muren 23.9.50.

Ramaricium occultum John Erikss. — Brämsand bland *Hylocomium splendens* 20.11.49 (J. E., U). Se vidare Eriksson 1954.

Stereum bicolor Fr. — Fl., på björk eller al (2 kollekter i U).

S. fasciatum Fr. — Billudden vid insjön, karaktärsart för döda stammar och stubbar av al (4 kollekter i U, tidigast 19.10.41, Sbg), Brämsand 30.9.45 (U), S om Gårdskär 4.11.45 (U), Långören Ö om Gårdskär 27.8.50, S om Fårskär 23.9.54. Alltid på al.

S. frustulatum (Fr.) Fuck. — Brämsand på lövved 20.11.49 (J. E., U), området Björkö—Storö fl. på levande och döda ekar 21.10.53 och senare (U).

S. hirsutum Fr. — Fl.

S. pini Fr. — Billudden på kvarsittande döda tallgrenar 16.10.49 (J. E., U) och senare.

S. purpureum Fr. — Fl.

S. rufum Fr. — Storöbron på asp 11.10.54.

S. rugosum Fr. — Fl. (3 kollekter i U). På hassel, ek eller al.

S. sanguinolentum Fr. — Fl.

Hymenochaete cinnamomea (Fr.) Bres. — Billudden vid insjön på död stam av en 20.11.49 (J. E., U).

H. rubiginosa (Fr.) Lév. — Nära Storöbron på ekar 21.8.49 (U) och senare, Brämsand på torrved (ek?) på marken 20.11.49 (J. E., U), Björkön på ek 28.8.54.

H. tabacina (Fr.) Lév. — Billudden på sälggren i rishög 20.9.44 (Sbg, U), Brämsand på lövved 20.11.49.

Aleurodiscus acerinus (Fr.) v. Höhn. & Litsch. — Billudden nära Klyxen på al 29.9.46 (R. Santesson, U), Brämsand på alm 11.10.54.

A. roseus (Fr.) v. Höhn. & Litsch. — Brämsand 20.11.49.

Coniophora arida (Fr.) Karst. — Billudden vid Billhamn på tallgren på marken 20.10.49 (S. L. & J. E., U).

Coniophorella olivacea (Fr.) Karst. — Storöbron på barrved 11.10.54.

Corticium bicolor Peck. — Storöbron på lövved 11.10.54.

C. byssinum (Karst.) Massee. — Billudden vid Billhamn på korkflöte på marken 20.11.49 och vid insjön på murken alved 16.10.49 (J. E., U), Storöbron 11.10.54.

C. citrinum Pers. [=*Gloeocystidium citrinum* (Pers.) Lundell]. — Billudden vid insjön på albark 7.10.45 (Nannf., N. Fries & Sbg, U), Brämsand på gran 11.10.54 (U).

C. commixtum Litsch. — Storöbron på ek 21.10.53 (U). Ny för Sverige.

C. confluens Fr. — Billudden vid insjön på murken alved 16.10.49 samt Ö och V om Billhamn på döda havtornsstammar 20.11.49 (J. E., U).

C. crustaceum (Karst.) v. Höhn. & Litsch. — Billudden vid insjön på fallen alstam 7.10.45 (Nannf. & Sbg, U) och 20.10.49 (S. L. & J. E., U).

C. diademiferum Bourd. & Galz. — Billudden vid insjön på murken alved 16.10.49 (J. E., U).

C. epiphyllum Pers. [=*C. centrifugum* (Lév.) Bres.]. — Billudden vid insjön på murken lövved 20.10. och 20.11.49 (S. L. & J. E., U), Brämsand på murken alstock, på murken lövved och på döda kvistar av *Lonicera xylosteum* 20.11.49 (J. E., U).

C. evolvens Fr. — Mellan jvstn och Älvkarleö bruk på hassel 11.10.54.

C. furfuraceum Bres. — Storöbron på timmerstock 11.10.54 (U).

C. fumosum Fr. — Billudden vid insjön på murken tallved 20.11.49 (J. E., U), Storöbron på tall 11.10.54.

C. Galzinii Bourd. — Brämsand på en 20.11.49, Billudden vid insjön på lövved 20.11.49 (J. E., U), Storöbron på ek 21.10.53 och 11.10.54 (U).

C. glaucinum Bourd. & Galz. — Brämsand på lövved 11.10.54 (U).

C. Lundellii Bourd. ap. J. Erikss. — Billudden vid insjön på nedfallen tallkvist 20.11.49 (J. E., U).

C. microsporum (Karst.) Bourd. & Galz. — Storöbron på murken ved på marken 11.10.54 (U).

C. mutabile Bres. — Brämsand på grankvistar i rishög 20.11.49 (J. E., U).

C. Neuhoffii Bres. (=*C. arachnoideum* Berk.) — Billudden vid insjön på murken alved 20.10.49 (S. L. & J. E., U).

C. ochraceum Fr. [=*Gloeocystidium ochraceum* (Fr.) Litsch. ap. Bourd. & Galz.] — Storöbron på barrved 11.10.54.

C. portentosum Berk. & Curt. — Billudden vid insjön på fallen alstam 7.10.45 (Nannf. & Sbg, U), Storöbron på ek 21.10.53.

C. pruina Bourd. & Galz. — Brämsand på tallstubbe 20.11.49 (J. E., U).

C. Romellii (Litsch. ap. Bourd. & Galz.) Lundell. — Storöbron på barrved på marken 11.10.54 (U).

C. tessulatum Cke. — Storöbron på murken barrved 11.10.54 (U).

C. trigonospermum Bres. — Billudden vid insjön på liggande murken alstam 20.10.49 (S. L. & J. E., U), Storöbron på *Hylocomium triquetrum* 11.10.54 (U).

C. tuberculatum Karst. — Billudden vid insjön på nedfallen algren 16.10.49 (J. E., U) och 20.10.49 (S. L. & J. E., U).

Cytidia salicina (Fr.) Burt. — Billudden 20.11.49, Storöbron 21.10.53. På sälg.

Pellicularia botryosa (Bres.) Nannf. & J. Erikss. in sched. — NV om Ambricka på bränd ek 14.10.53, Storöbron på resterna av gammal koja 11.10.54 (U).

P. subcoronata (v. Höhn. & Litsch.) Rogers. — Brämsand på al 20.11. 49, Storöbron på död *Polyporus nigrolimitatus* 11.10.54 (U).

Peniophora affinis Burt. — Storöbron på ved på marken 11.10.54 (U).

P. alutaria Burt. — Gårdskärs fiskehamn på fallen gran 14.10.53, Brämsand på barrved 11.10.54 (U).

P. argillacea Bres. — Billudden i V strandsnåret N om Billhamn på murken drivved 20.10.49 (S. L. & J. E., U).

P. byssoides (Fr.) v. Höhn. & Litsch. — Fl. (U).

P. candida (Fr.) Lyman. — Billudden vid insjön på murken alved 16.10. och 20.10.49 (S. L. & J. E., U).

P. cinerea (Fr.) Cke f. *typica* — Billuddens S del på hassel 10.11.46 (Sbg, U).

P. cremea (Bres.) Sacc. & Syd. — Båtfors på murken ekved 4.6.49 (U).

P. gigantea (Fr.) Massee. — NV om Ambricka på tall 14.10.53.

P. glebulosa (Bres.) Sacc. & Syd. — Billudden N om Billhamn på V stranden på drivved i strandsnåret samt vid insjön på tallgren på marken 20.10.49 (S. L. & J. E., U).

P. hastata Litsch. — Billudden vid insjön på död enstam 20.10.49 (S. L. & J. E., U), Storöbron på murken barrved 11.10.54 (U).

P. heterogenea Bourd. & Galz. — Billudden vid insjön på murken alved 20.10.49 (S. L. & J. E., U).

P. hydnoides Cke & Massee ap. Massee [= *Odontia hydnoides* (Cke & Massee) v. Höhn.]. — Billudden vid insjön på murken alved 16.10.49 (J. E., U).

P. incarnata (Fr.) Karst. — Mellan jvstn och Älvkarleö bruk på hassel 11.10.54.

P. junipericola J. Erikss. — Billudden vid insjön på döda grenar av en 16.10.49 (J. E., U), 20.10.49 (S. L. & J. E., U) och senare.

P. laevigata (Fr.) Karst. — Billudden på en 20.11.49, Storöbron på en 11.10.54.

P. mollis (Bres.) Bourd. & Galz. — Brämsand på murken bränd ved 20.11.49 (J. E., U).

P. mutata (Peck) v. Höhn. & Litsch. — Billudden vid insjön på död rönn och på död hägg 20.10.49 (S. L. & J. E., U).

P. pallidula (Bres.) Bres. ap. Bourd. & Galz. — Storöbron 4.10.50 (U).

P. polygonia (Fr.) Bourd. & Galz. — Storöbron på asp 11.10.54.

P. pubera (Fr.) Sacc. — Billudden vid insjön på murken alved 16.10. 49 (J. E., U).

P. sanguinea (Fr.) v. Höhn. & Litsch. — Storöbron 11.10.54.

P. setigera (Fr.) v. Höhn. & Litsch. — Billudden vid insjön på rötad rönnstam 20.10.49 (S. L. & J. E., U).

P. subalutacea (Karst.) v. Höhn. & Litsch. — Billudden vid insjön på murken ved 20.10.49 (S. L. & J. E., U).

P. tenuis (Pat.) Massee [=*Gloeocystidium praetermissum* (Karst.) Bres.] — Billudden vid insjön på murken alved 20.10.49 (S. L. & J. E., U), på murken lövved 20.11.49 (J. E., U) och V om Billhamn på drivved i strandsnåret 20.11.49 (J. E., U), Storöbron på ek 11.10.54 (U).

P. velutina (Pers.) Cke f. *pallida* — Brämsand på gråal 11.10.54 (U).

Solenia ochracea Fr. — Billudden vid insjön på murken ved på marken 20.10.49 (S. L. & J. E., U).

Vuilleminia comedens (Fr.) Maire. — Fl., på ek och al.

Thelephora caryophyllea Fr. — Brämsand vid Dalälven 9.9.51.

T. palmata Fr. — Billudden 9.9.45 och senare, mellan Nabben och Gårdskär 3.10.46.

T. terrestris Fr. — Fl.

Tomentella Bresadolae (Brinkm.) Bourd. & Galz. — Brämsand på lövved 11.10. 54 (U).

T. echinospora (Ell.) Bourd. & Galz. — Brämsand på ved 11.10.54 (U).

T. fusca (Fr.) Schroet. — Billudden vid insjön på liggande alstam 16.10.49 (J. E., U).

T. Jaapii (Bres.) Bourd. & Galz. — Billudden intill Brämsand på murken ved av *Alnus incana* 29.9.46 (Sbg, U).

T. mucidula (Karst.) v. Höhn. & Litsch. — Billudden på död gren av en och på murken alved 16.10.49 (J. E., U).

T. pallido-fulva (Peck) Litsch. — Billudden vid insjön på murken fallen alstam 20.10.49 (S. L. & J. E., U).

Tomentellina bombycina (Karst.) Bourd. & Galz. — Brämsand på gran 11.10.54.

Bourdotia caesio-cinerea (v. Höhn. & Litsch.) Bourd. & Galz. — Brämsand på murken ved av *Salix* 20.11.49 (J E., U), Storöbron på ek 21.10.53.

Eichleriella spinulosa (Berk. & Curt. ap. Berk.) Burt. — Billudden på *Rhamnus cathartica* 1929 (Sbg), på hägg 20.11.49, Brämsand på alm 11.10.54.

Exidia cartilaginea Lll & Neuh. ap. Neuh. — Storön på rönn 17.9. 1916 (E. Almquist, U), Storöbron på lövved 21.10.53.

E. saccharina Fr. — Billudden vid insjön på nedfallen tallgren 20.11. 49 (J. E., U).

E. truncata Fr. — Storöbron på ekstock 21.10.53.

Protohydnum piceicola Kühner. — Billudden nära insjön 20.11.49 (J. E. m. fl., U).

Sebacina calcea (Pers.) Bres. — Billudden vid insjön på fallen granstam 20.10.49 (S. L. & J. E., U), Brämsand på gran 20.11.49.

Tremella foliacea Fr. — Billudden vid insjön 9.9.45, Storöbron 4.10.50, Flat 26.8.51.

T. foliacea Fr. var. *fimbriata* (Fr.) Lll. — Billudden S delen, Ö om vägen, på gråal 29.9.46 (Sbg, U).

T. mesenterica Fr. — Sågarbo 30.9.45, Nabben 2.9.46, S om Fårskär 23.9.54.

Tremellodon gelatinosum Fr. — Gårdskär 4.11.45, Sågarbo 26.9.46.

Calocera cornea Batsch. — Billudden 20.11.49.

C. viscosa Fr. — Sågarbo 9.9.45 o. senare, Fårskär 26.10.52.

Dacrymyces deliquescens (Bull.) Duby. — Billudden 7.10.45 (N. Fries, Sbg & Nannf., U), Brämsand på barrved 20.11.49 (J. E., U).

D. punctiformis Neuh. — Billudden N om Billhamn på drivved på V stranden 20.10.49 (S. L. & J. E., U).

Tulasnella Eichleriana Bres. — Brämsand på lövved 11.10.54.

T. lactea Bourd. & Galz. — Billudden vid insjön på murken alved 20.11.49 (J. E., U).

Helicogloea farinacea (v. Höhn.) Rogers ap. Martin. — Billudden vid Billhamn på död enstam 20.10.49 (S. L. & J. E., U).

H. Lagerheimii Pat. — Billudden vid insjön på tallstubbe 20.11.49 (J. E., U), Brämsand på murken ved 20.11.49 (J. E., U).

Gastromycetes.

Bovista nigrescens Pers. — Sågarbo 9.9.45.

B. plumbea Pers. — Rikligt på gräsmattorna längs älven 10.9.1910 (Fries 1910), Billudden fl. på torra sandmarker (Sandberg 1940), på ängen vid Klyxen 30.9.45 (Sbg, U), Brämsand 29.9.46 (R. Santesson, U).

B. tomentosa (Vitt.) De Toni. — Brämsand 11.10.54 (Sbg, U).

Bovistella echinella (Pat.) Lloyd. — Växande täml. rikligt på öppnare, mossklädda fläckar bland lågt gräs invid älven, 11.9. 1910 (Fries 1910); Kullens fiskeläge vid älven 20.9.38 (Sandberg 1940), Billudden på stigen framför jaktvillan okt. 1934 (Sandberg 1940) o. 30.9.45, nära insjön 29.9.46 (R. Santesson, U).

B. paludosa (Lév.) Lloyd. — N om Bölsjön 21.8.52. Confirm. F.-E. Eckblad.

Calvatia Bovista (Pers.) Th. Fr. j:r. — På ett par ställen på gräs- och örtrik mark 10.9. 1910 (Fries 1910), Brämsand 21.8.52, Karlsäter 23.9.54.

C. saccata (Fr.) Morgan. — Sågarbo 9.9.45, Gårdskärs fiskehamn 14.9.49, Älvkarleön 9.9.51.

Lycoperdon nigrescens (Pers.). — Sågarbo 9.9.45.

L. perlatum Pers. — Allm. (Fries 1910), Sågarbo 9.9.45, Billudden 7.10.45 (N. Fries, Nannf., Sbg, U).

L. polymorphum Vitt. — Riklig på järnvägsbanken vid Älvkarleö stn 10.9. 1910 (Fries 1910).

L. pratense Pers. — Längs järnvägslinjen (Fries 1910).

L. pyriforme Pers. — Riklig på järnvägsbanken vid Älvkarleö stn (Fries 1910), Billudden 19.10.41 (Sbg, U) o. 9.9.45.

Rhizopogon luteolus Fr. — Järnvägsparken tills. med *Rh. roseolus* fast sparsammare (Fries 1910), Brämsand (i grävda rabatter) 24.9.50 o. 8.10.50.

Rh. roseolus (Corda) Zeller & Dodge. — Järnvägsparken rikligt vid vägkanten (Fries 1910), N delen av Billudden 1934 (Sandberg 1940), Brämsand 24.9.50, nära Stensångersjön 26.8.51.

Geaster fimbriatus Fr. — Älvkarleö 30.5. 1899 (K. Hedbom, U), ett ex. i granskogen (Fries 1910), Brämsand o. Billudden flerstädes (flera kollekter i U), tidigast funnen under Sernanders exkursion 1927 (se Sandberg 1940).

G. minimus Schw. — Billudden 25.8.29 o. senare (Sbg, U, se även Sandberg 1940), Brämsand på två lokaler i skogen mot Dalälven 27.8. 50 (U), och i enbuskzonen närmare stranden 11.10.54 (Sbg, U).

G. pectinatus Pers. — Billudden, N delen 14.10.34 o. senare (Sbg, U, se även Sandberg 1940).

G. quadrifidus (Pers.) Th. Fr. j:r. — Billudden 14.10.34 o. senare (Sbg, U, se även Sandberg 1940), Brämsand 9.9.45 o. senare.

G. triplex Jungh. — Billudden 14.9.34 (Dagmar Sandberg, se Sandberg 1940) o. senare (U), Brämsand 30.9.45 o. senare.

Crucibulum vulgare Tul. — Fl. Se även Fries 1910 o. Sandberg 1940.

Cyathus olla Pers. — På jord vid Turisthotellet 10.9. 1910 (Fries 1910).

C. striatus Pers. — Billudden fl. (U), tidigast på multnande drivved på uddens N del okt. 1934 (Sandberg 1940); Nabben 2.9.46.

Nidularia confluens Fr. — Billudden på multnande kvistar i alsnår vid Klyxen samt på drivved vid Sågarbofjärden 6.10.40 (Sandberg 1940).

Gautieria graveolens Vitt. — Laxön aug. 1891 (A. Zethelius, U).

Hysterangium clathroides Vitt. — Älvkarleö aug. 1910 i barrskogen invid landsvägen (G. Lagerheim, U).

Phallus impudicus (L.) Pers. — Skutskär 8.8.1903 (J. A. Z. Brundin, se Th. C. E. Fries 1918), Billudden nära insjön okt. 1934 (Sandberg 1940) o. senare, Sågarbo 30.9.45, Fårskär 4.9.46, S om Gårdskär 4.9.46, o. senare; S om Fårskär 23.9.54, Långören 27.8.50, Gårdskärs fiskehamn 3.9.50.

Scleroderma verrucosum Pers. — Vid järnvägslinjen mellan Älvkarleö stn och bruket 11.9. 1910 (Fries 1910, U).

Sphaerobolus stellatus Pers. — På multnande gärdsgårdsstänger 10.9. 1910 (Fries 1910), vid Klyxen och Sågarbofjärden på drivved och kvistar okt. 1940 (Sandberg 1940), Billudden vid Källvik 30.9.45 (Sbg, U).

Tulostoma brumale Pers. — Billudden på Ö stranden mellan Billhamn o. Billskaten 15.6.31 o. senare (Sandberg 1940, U), Brämsand 10.11.46 o. senare (Sbg, U)

Discomycetes.

Operculati.

Aleuria aurantia (Fr.) Fuck. — Nabben 14.9.49 (U).

Anthopeziza protracta (Fr.) Nannf. — Brämsand vid Billuddens bas, strax innanför skogsbrynet mot havet 10.11.46 (T. Hasselrot, U). Jfr Nannfeldt 1949.

Geopyxis carbonaria (Fr.) Sacc. — Gårdskärs fiskehamn på brandfläckar 14.9.49.

Gyromitra infula (Fr.) Quél. — Fl.

Helvella crispa Fr. — Laxön 10.9. 1910 (Fries 1910), Billudden och Brämsand 30.9.45 o. senare (13.10.46 mycket ymnig), Gårdskärs fiskehamn 14.9.49, S om Fårskär 23.9.54.

H. elastica Fr. — Fl. (2 kollekter i U samt utdelad i Fungi suec. exs. (nr 2064) från Billudden). Allmän i området Turisthotellet –Älvkarleö bruk 10.9. 1910 (Fries 1910).

H. lacunosa Fr. — Fl. (2 kollekter i U). — Den av Fries 1910 anförda *H. sulcata* Fr. torde vara identisk med *H. lacunosa*.

H. macropus (Fr.) Karst. — Fårskär 4.9.46.

Lachnea hemisphaerica (Fr.) Gill. — Billudden N om Källvik på Ö stranden 7.10.45 (N. Fries, Sbg & Nannf., U) och senare.

L. scutellata (Fr.) Gill. – Billudden vid vägen 20.8.29 (Sbg, U) och vid insjön 7.10.45 (N. Fries, Sbg & Nannf., U), Nabben 2.9.46.

Otidea auriformis Nannf. in sched. — Billuddens N del i barrblandskog 19.10.41 (Sbg, U).

O. bufonia (Pers.) Boudier. — Billudden i *Hylocomium*-matta 19.10.41 (Sbg, U).

O. onotica (Fr.) Fuck. — Sågarbo 9.9.45.

Peziza echinospora Karst. — Gårdskärs fiskehamn på brandfläckar 14.9.49 (U).

P. cfr *olivacea* Boudier. — Gårdskärs fiskehamn i alkärr 14.9.49 (U).

P. repanda Fr. — Billudden 2 lokaler på S delen 3.9.29 (Sbg, U) och 30.9.45, Gårdskärs fiskehamn på sågspån 14.9.49.

P. vesiculosa Fr. — Brämsand i avfallsgrop 24.9.50.

Plectania coccinea (Fr.) Fuck. — Billudden (se Sandberg 1948).

Rhizina undulata Fr. — Nabben och Gårdskärs fiskehamn på brandfläckar 14.9.49 (U).

Sepultaria arenicola (Lév.) Massee. Brämsand 18.9.44 (Sbg, U).

S. cfr *foliacea* Boudier. — Brämsand på öppna fläckar i sandskogen 24.9.50 och 8.10.50 (U).

Sowerbyella unicolor (Gill.) Nannf. — Brämsand 30.9.45 (U). Det första fyndet i Sverige av denna art. Numera också funnen på 2 lokaler på Gotland.

Inoperculati.

Fam. *Helotiaceae.*

Coryne sarcoides (Fr.) Tul. Billudden på dött lövträd 2.9.29 (Sbg, U).

Helotium aeruginosum Fr. — Billudden vid insjön 9.9.45, Gårdskärs fiskehamn 14.10.53.

H. citrinum Fr. — Billudden vid insjön 30.9.45 o. senare, nära Klyxen 29.9.46 (R. Santesson, U).

H. fructigenum Fr. — Billudden på fallna algrenar 13.10.46 (L. Holm, U).

H. versiforme (Fr.) B. & Br. — Billudden på alved 7.10.45 (N. Fries, Sbg, Nannf., U).

Phaeobulgaria inquinans (Fr.) Nannf. — Storön fl. på ekstockar 4.10. 50 o. senare.

Fam. *Geoglossaceae.*

Cudonia circinans Fr. — Billskaten 7.10.45 (N. Fries, Sbg & Nannf., U).

C. confusa Bres. — Billudden 19.10.41 (Sbg, U), N om hamnen 30.9. 45 (Sbg, U).

Geoglossum Cookeianum Nannf. — Billskaten och insjöängen 7.10.45 (N. Fries, Sbg & Nannf., U).

G. glabrum Fr. — Bölsjön 6.8.50 (Nannf., U).

G. nigritum Cke. — Vid vägen Sågarbo—Långasand 14.9.49, Gårdskärs fiskehamn vid vägen strax S om bodarna 14.9.49.

Leotia lubrica Fr. — S om Gårdskär 4.9.46, Brämsand 26.9.46.

Mitrula abietis Fr. — Billudden S om insjön 19.10.41 (Sbg, U), SO om Gårdskär 4.11.45 (U).

Spathularia flavida Fr. — Fl.

Pyrenomycetes.

Fam. *Hypocreaceae.*

Claviceps purpurea (Fr.) Tul. — Brämsand på *Elymus* 13.10.46 (L. Holm, U).

Cordyceps militaris (Fr.) Link. — Brämsand vid Billuddens bas 10.11. 46 (Sbg, U).

C. ophioglossoides Fr. — Billudden 7.10.45 (N. Fries, Sbg & Nannf., U).

Hypocrea fungicola Karst. — Billudden på *Polyporus pinicola* 2.9.29 (Sbg).

H. gelatinosa Fr. — Billudden vid insjön på gammal lövved 30.9.45 (U).

H. pulvinata Fuck. — Billudden på *Polyporus* 2.9.29 (Sbg, U), Fårskär c. 500 m S om sjöbodarna på *Polyporus betulinus* 10.8.44 (Nannf., U).

H. stipata (Lib.) Fuck. — Billudden vid insjön på barkstycke på marken i fuktig alskog 16.10.49 (J. E., U).

Tuberales.

Geopora Schackii P. Henn. — Billudden 30.9.45, 7.10.45 och 29.9.46 (Sbg, U). Detta fynd har ingående diskuterats av Nannfeldt 1946.

Summary.

Some notes on the fungous flora of Älvkarleby, Uppland, Central Sweden.

A list is given of *Hymenomycetes, Gastromycetes,* and *Ascomycetes* found in Älvkarleby parish, Uppland, Sweden (area about 230 km², latitude *c.* 60°30′N, longitude *c.* 17°30′E, see map on p. 772). This part of Uppland is known to botanists for its rich phanerogamous flora characterized by many species with a southern distribution. The *Gastromycetes* of the "Billudden" peninsula have also been thoroughly investigated (Sandberg 1940).

The list shows that the fungous flora contains several southern species, some of which here occur at the northern limit of their

distribution in Sweden. Some of these are more or less confined to oak (*Quercus robur*), others seem to be calciphilous. In addition, a few fungi with a northern distribution, have been observed. Representatives of these groups, as well as a number of rare species, are listed on p. 774.

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SMÄRRE UPPSATSER OCH MEDDELANDEN.

Föreningens medlemmar uppmanas att till denna avdelning insända meddelanden om märkliga växtfynd o. d.

New Hepatics Found in Sweden and Norway.

Lophozia latifolia Schuster. — This species is described in The Bryologist, Vol. 56, p. 257—276 (1954). It resembles *L. excisa* in having vinous red gemmae, but differs in being dioicous and having broader leaves, the breadth generally 1.2—1.4 times the length. The angles of the gemmae are more obtuse than in *L. excisa*. The species has been collected in several localities in the Torneträsk and Peldsa areas, first time by me in Björkliden 1938 (as *L. excisa* var. *palustris* ined.), further in Norrbotten, Överkalix, Rautasjärvi (1943). It grows in fens together with *Harpanthus Flotowianus*, *Marchantia alpestris*, *Obtusifolium* (*Leiocolea*) *obtusum*, etc., but also in drier localities. The highest altitude is 1570 m.s.m. (Nissontjårro, O. Mårtensson and S. Arnell, 1954). I have also collected it in Norway, Narvik, near Fossestuen (1938).

Lophozia excisa (Dicks.) Dum. var. ***grandiretis*** nov. var. — Cellulae marginales folii 30 × 30—40 μ, gemmae 30 × 40—40 × 50 μ, flavo-rubrescentes. — The form of *L. e.* growing in the Torneträsk area differs in some respects from the southern Scandinavian forms. It is generally of larger size than *L. latifolia* and has larger cells than this species and the southern forms of *L. e.* Marginal cells of the leaves 30 × 30—40 μ, cells of the leaf-middle about 30 × 50 μ, walls thin, trigones small. Gemmae 30 × 40—40 × 50 μ, angular, orange to colourless. Torne Lappmark, several localities near Abisko.

Lophozia opacifolia Culman (Rev. Bryol., 47, p. 21, 1920). — Differs from the near-related *L. incisa* (Schrad.) Dum. by having the leaves obtusely and sparsely dentate and wider than long, the base of the leaves 3—5 cells thick (in *L. incisa* 2 cells thick) and by the mouth of the perianth, which is shortly dentate or almost entire. It is rather common in the Torneträsk area and grows on more or less peaty soil. It will probably be found in the whole Scandinavian mountain range.

Orthocaulis cavifolius Buch and S. Arn. — This rare species was found by Hampus Arnell 1953 in Norway, Nordlands fylke, Lofoten, Austvågöy, on a rinsed stone near Trollvand, about 225 m.s.m. The species

is new for Norway. It has earlier been found in a few localities in the Peldsa and Torneträsk areas in an altitude of 1000—1500 m.s.m. and in Härjedalen, Helagsfjället.

S. Arnell.

Fynd av brandnäva i Åker.

Eftersom brandnävan (*Geranium lanuginosum*) är en i Sverige sällsynt och kanhända förbisedd art, kunde kanske några notiser om dess uppträdande denna sommar i Åker, Södermanland vara av intresse.

Undertecknad fann i Åker för cirka tio år sen för första gången några brandnävor tillsammans med hundratals svedjenävor (*G. bohemicum*). På lokalen, där de växte, hade man bränt. Efter nära ett decennium har brandnävan dykt upp igen i socknen men nu på helt annan slags växtplats.

Under de senaste åren har en del nya vägar brutits i skogsområdet. I den blottade, undanskuffade moränen vid vägsidorna och på själva vägkanterna av de nya vägarna har jag i sommar på flera ställen dels funnit mängder av svedjenävor men också på fem skilda lokaler brandnävor. På tre av dessa fyndplatser förekom endast ett ex., vid de två andra var det 3—4 st. Det var således mycket få brandnävor, men som sagt på flera skilda men liknande lokaler.

Brand- och svedjenävorna tycks tydligen kunna förekomma utan samband med eld, vilket är iakttaget förut, men det är anmärkningsvärt, att de i sommar i sådan mängd påträffats efter vägarna här. Kanhända har den grusiga moränen, där de spirat upp, under våren och försommaren varit tillräckligt uppvärmd, för att de värmekrävande fröna skulle kunna gro. (Fastän det sedan blev regnigt, var det i trakten ovanligt varmt i slutet av maj.)

I flera fall var brandnävan nästan helt utblommad, när jag fann den i början av juli. I ett par fall hade man endast några frukter med frön att tillgå för att bestämma arten, då bladen vissnat, och det då var svårt att känna igen brandnävan. Brandnävorna tycktes i allmänhet vara något tidigare än svedjenävorna, men på en av lokalerna blommade en brandnäva rikt så sent som i slutet av aug. Även om flertalet nävor var i fruktstadiet eller helt nedvissnade i början av aug., fanns emellertid i slutet av månaden små rosetter av nygrodda svedjenävor, vars hjärtblad hade den typiska inskärningen i sidorna.

Allan Johansson.

Nytt fynd av Epipogium i norra Östergötland.

Under en exkursion i Kvillinge socken i norra Östergötland den 27 juli 1954 tillsammans med fil. dr Edv. von Krusenstjerna påträffades ett blommande exemplar av *Epipogium aphyllum* och vid närmare undersökning ytterligare 2 ex. i knoppstadium.

Lokalen, som på grund av nedfallna grenar och sin kuperade struktur var ganska svåröverskådlig, var belägen på en mot norr vättande skog-

klädd bergsluttning söder om Ågelsjön. Den närmaste träd- och buskvegetationen utgjordes av gran och lind med *Lonicera xylosteum, Viburnum opulus* och *Ribes alpinum.* I fältskiktet noterades: *Lycopodium selago, Thelypteris dryopteris, Melica nutans, Luzula pilosa, Paris, Vicia silvatica, Actaea, Anemone hepatica, Fragaria vesca, Geranium silvaticum, Oxalis acetosella, Campanula persicifolia, Solidago* och *Lactuca muralis.* Marken var till stor del betäckt med i förmultning befintliga löv.

Vid ett förnyat besök den 8 aug. voro de ovannämnda outslagna exemplaren i blom samt iakttogos ytterligare två blommande ex. Den 29 aug. voro samtliga ex. utblommade.

Den nytillkomna lokalen ansluter sig till ett antal tidigare — mestadels för rätt länge sedan — gjorda fynd inom angränsande delar av Östergötland och Södermanland (jfr sammanställningarna av Frisendahl i Sv. Bot. Tidskr., 1910, och Arwidsson i Bot. Not. 1929 samt Hulténs Atlas).

Erik Genberg.

Nytt fynd av Epipogium i Västergötland.

Vid en exkursion i trakten av Bölet i Undenäs kommun av Skaraborgs län den 3 augusti i år påträffades två exemplar av *Epipogium aphyllum.* Det ena var halvt förvissnat och hade två blommor. Det andra var friskt och hade tre vackra blommor. Växtplatsen var belägen i Granviks socken c:a 1 km nordväst om Pukeryd å en fuktig södersluttning i gammal granskog. *Epipogium* är funnen i Undenäs senast år 1944, dock ej på denna plats (se Karl & T. E. Hasselrot i Sv. Bot. Tidskr. 1953). Egendomligt nog är det andra gången som undertecknad påträffat denna sällsynta gäst i Floras rike. Första gången inträffade det i Dalarna på gränsen till Hälsingland.

Karl Hasselrot.

Sumpviolen (Viola uliginosa Bess.) funnen i Stockholmstrakten.

Under en promenad i Täby norr om Stockholm den 24 maj innevarande år hade jag glädjen att oförmodat påträffa en rik förekomst av ovannämnda art, som jag då såg för första gången, och vilken tidigare av allt att döma icke torde ha blivit funnen som spontan i Stockholmsområdet (Stockholmstraktens växter 1937, jfr nedan). Växtplatsen — ett kärr i blandskog av klibbal och björk med sparsamt inslag av gran — är belägen i Täby köping, strax NO om Mörtsjön, vid den stig, som från Fjäturs vägen (där denna möter Skarpängsvägen) leder till sjön Fjäturens sydöstra vik. Den intressanta upptäckten gjordes, då jag begivit mig ut i kärret på jakt efter den fuktighetsälskande laven *Menegazzia pertusa,* för vilken lokaltypen syntes mig mycket passande. Under mitt fåfänga sökande efter laven i fråga befann jag mig plötsligt mitt uppe i *Viola*-beståndet, som just stod i fullt flor och i den rådande belysningen — det var en klar, molnfri dag, och solstrålarna silade in genom luckor i lövverket — erbjöd en utomordentligt praktfull anblick.

Fig 1. *Viola uliginosa* i skogskärr NO om Mörtsjön i Täby köping, Uppland. (I bakgrunden till vänster *Viola palustris*.) Foto: Eric Hultén $^{31}/_{5}$ 1954.

Arten förekom m. el. m. rikligt på en sträcka av omkr. 100 meter utmed stigen, särskilt på alarnas »socklar» och i strängformig anordning i mossmattan längs deras kraftigare rötter. Fig. 2 nedan — liksom fig. 1 efter färgfoto, taget av prof. Hultén en vecka efter upptäckten – torde ge en ganska god föreställning om växtsättet. Bland övriga i kärrets fältskikt ingående arter noterades (listan kompletterad 1/9 1954): *Anemone nemorosa*, *Caltha palustris*, *Carex echinata*, *Equisetum palustre*, *E. silvaticum*, *Galium palustre*, *Geum rivale*, *Glyceria fluitans*, *Juncus effusus*, *Lastrea dryopteris*, *Lysimachia vulgaris*, *Maianthemum bifolium*, *Melampyrum silvaticum*, *Menyanthes trifoliata*, *Oxalis acetosella*, *Peucedanum palustre*, *Potentilla erecta*, *P. palustris*, *Pyrola minor*, *P. rotundifolia*, *Ranunculus flammula*, *Rubus saxatilis*, *Ulmaria vulgaris*, *Vaccinium myrtillus*, *V. vitis-idaea* och *Viola palustris*. Det svagt utbildade buskskiktet domineras av *Rhamnus frangula*.

Som framgår av Hulténs »Atlas över växternas utbredning i Norden» (1950) är sumpviolen en östligt-kontinental, kalkgynnad art med anknyt-

Fig. 2. Bild från samma lokal som på fig. 1, visande rikt blommande bestånd av *Viola uliginosa* på alsockel i kärret (jfr texten). Foto: Eric Hultén $^{31}/_{5}$ 1954.

ning till Baltikum, i vårt land funnen på spridda lokaler i de östra landskapen från Dalälvens mynningsområde till Blekinge samt i Skåne.

Viola uliginosa är, som nämnts, sannolikt ny för Stockholmsområdet i den avgränsning detta givits i Stockholmstraktens växter (1914, 1937). Lektor Erik Almquist har i brev meddelat mig, att den, så vitt han har sig bekant, icke blivit funnen därstädes, »om man bortser från Sundstedts inplantering på Lidingön och den uppgivna förekomsten vid Norrtälje. Jag misstänker, att denna i själva verket avser växtplatsen i Estuna (strax N om stadsområdet). Denna har i Stockholmstraktens växter av misstag kallats Färsna, bör vara Räfsja (jfr Sv. Bot. Tidskr. 1921 s. 271). Jag har hört, att arten där lär finnas på 2 ställen.»

T. E. Hasselrot.

Ett par anmärkningsvärda Carex-fynd i Skepplanda socken i västra Västergötland.

Vid fortsatta exkursioner i det vad kärlväxtfloran beträffar numera ganska grundligt undersökta området mellan Anten—Mjörn-dalen och Göta älv i västra Västergötland (se Skårman i Sv. Bot. Tidskr. 1935, 1941, 1942, 1943, Hasselrot ibid. 1953) påträffades den 2/7 och 6/7 sistlidna sommar oväntat de båda m. el. m. kalcifila *Carex Buxbaumii* och *C. lepidocarpa* på vardera en lokal i den till skogsområdet Risveden hörande östra delen av Skepplanda socken. Båda fynden gjordes inom det märkliga *Cladium*-stråk, som från socknen i fråga sträcker sig in i västra Östad (ll. cc.).

Carex Buxbaumii upptäcktes under ett resultatlöst letande efter gotlandsagen vid några förut icke besökta sjöar. Växtplatsen utgöres av ett kärr vid avloppet från den lilla Mellersta Kvarnsjön Ö om Ekliden, där arten förekom i ett begränsat men ganska individrikt bestånd helt nära sjön, tillsammans med *Eriophorum latifolium*. Från kärret noterades bl. a. också *Carex dioeca* och *hostiana* och från ett angränsande gungfly, tillhörande samma myrkomplex, *Carex limosa*, *Drosera anglica*, *Rhynchospora fusca* och *Scheuchzeria palustris*.

Hulténs »Atlas över växternas utbredning i Norden» (1950, kartan fig. 390) upptar endast en fyndort för *C. Buxbaumii* i västra Västergötland: Floda i Skallsjö socken (ca 20 km SSO om Skepplanda-lokalen), varifrån beläggexemplar föreligger i Riksmuseets samlingar (1896 H. Fries); jfr Rudbergs »Förteckning öfver Västergötlands fanerogamer och kärlkryptogamer» (1902). »Skallsjö, Oskarshöjd» (1899 Axel Liljedahl) hos Cajander [Kalela] i Ann. Bot. Soc. Zool.-Bot. Fenn. Vanamo, Tom. 5 (1934—35) torde avse samma lokal. I motsats till den närstående *C. Hartmanii* har *C. Buxbaumii* inom landskapet icke anträffats i Vänern- och Göteborgsområdena och saknas till skillnad från nämnda art också helt i Bohuslän (se Cajander l. c., Fries' »Göteborgs och Bohus läns fanerogamer och ormbunkar», 1945).

Carex lepidocarpa påträffades under den senare exkursionen i en fuktäng med bl. a. *Carex flava* och *C. hostiana* NO om Slisjön, Ö om gården Kullen. (Närmare sociologiska anteckningar förhindrades av ett ihållande, häftigt åskregn.) Trakten kring sjön är redan genom Skårman känd som en av de i floristiskt avseende rikaste i hela det av honom inventerade området, med ett påfallande starkt inslag av m. el. m. kalkgynnade till kalkkrävande element. Två inom detsamma eljest icke observerade resp. mycket sparsamt företrädda *Carex*-arter, *C. appropinquata* och *C. acutiformis*, ha av honom förut noterats därifrån (se hans ovan citerade arbete av år 1935). En av *Cladium*-sjöarna (Bergsjön) ligger också helt nära, liksom den isolerade fyndorten för *Neottia nidus-avis* (l. c.).

C. lepidocarpa är ny för västra Västergötland (inkl. Göteborgsområdet). Den är icke funnen i Dalsland och har i Bohuslän blott påvisats på två lokaler (Fries l. c.).

T. E. Hasselrot.

Arkiv av utbredningskartor i Naturhistoriska Riksmuseets botaniska avdelning.

Linné och hans lärjungar gjorde inga utbredningskartor över de växter de sysslade med. Man kände alltför få fakta angående deras förekomst särskilt i exotiska länder. Det skulle dröja till första hälften av 1800-talet innan de första utbredningskartorna för enskilda växtarter skulle komma till.

De första kartorna var linjekartor, där arealen omslöts av en begränsningslinje. Först långt senare kom prickkartorna, där varje fyndort representeras av en prick på kartan, och ännu senare kombinerade streckningsoch prickkartor, där man försöker ge ett intryck av allmänhetsgrad genom olika linjesystem och utmärker mera spridda förekomster med prickar.

De första egentliga prickkartorna publicerades, så vitt undertecknad känner, av Hermann Hoffmann i hans »Pflanzenarealstudien in den Mittelrheingegenden» i Bericht Oberhessische Ges. Natur u. Heilkunde 12, 1867—69, ett arbete långt före sin tid i växtkartografiskt avseende.

Prickmetoden togs sedan upp särskilt i Skandinavien och Finland och slog igenom ungefär år 1909 med Harald Lindbergs »Die nordischen *Alchemilla vulgaris*-Formen» med kartor i två färger för de olika arterna. Detta arbete följdes 1912 av Gunnar Anderssons och Selim Birgers klassiska arbete »Den norrländska florans geografiska fördelning och invandringshistoria». Därpå följde landskapsfloror med kartbilder av de flesta eller alla arterna: Sterners Ölandsflora och Almquists Upplandsflora, för att nämna ett par av de förnämsta.

Prickmetoden spred sig snabbt efter genombrottet i Skandinavien. De första arbetena med prickkartor för varje art berörande icke-skandinaviska floror var Lynges Novaja Zemljaflora (1921) och undertecknads Kamtchatkaflora (1927—1930). Det förtjänar dock att framhållas, att Hitchcock redan så tidigt som 1899 utgivit sin »Flora of Kansas», där en county-karta för varje art gives. Senare har antalet botaniska arbeten med utbredningskartor stigit i allt snabbare takt. I dag existerar uppskattningsvis omkring 40000 i den botaniska litteraturen.

Därmed har ett nytt problem uppkommit för var och en som vill utnyttja den kunskapsskatt, som finnes att hämta ur dessa kartor.

Ingen kan ha en sådan översikt över den botaniska litteraturen, att han vid behov kan plocka fram alla förefintliga kartor rörande en viss art, ännu mindre dem som röra en viss grupp av arter. Behovet av ett register över befintliga kartor gör sig allt starkare gällande. Liksom det finnes ett register över befintliga avbildningar av växtarterna — Index Londinensis — vore ett register över deras utbredningskartor mycket önskvärt. Undertecknad har emellertid i stället för att upprätta ett sådant register på Riksmuseets botaniska avdelning lagt upp ett arkiv av kartorna själva. Arbeten, som kunnat anskaffas, ha »slaktats» och kartorna klippts ut. Ur dyrbara eller svåranskaffade arbeten har kartorna kopierats med en kopieringsapparat, som ger positiva kopior. Kartorna ha därpå först ordnats i

bokstavsordning, varpå släktena försetts med nummer efter Dalla Torre & Harms »Genera Siphonogamarum», sedan har de omordnats i nummerordning. Inom släktena ordnas arterna i bokstavsordning. Den sålunda uppkomna kartserien har uppklistrats på herbariepappersark av formatet 38 × 26 cm. Varje art har fått sitt blad eller vid behov flera blad. Bladen har ställts på kant med namnet upptill till vänster och med stödjande pappskivor instuckna på lämpliga mellanrum. De ha placerats i 3 st. ca 135 cm höga s.k. vertikalskåp av järn från Rosengrens kassaskåpsfabrik med 4 lådor i varje skåp. Dessa lådor löpa utomordentligt lätt trots den tunga belastningen. Härigenom har ett arkiv över befintliga utbredningskartor skapats. Till en början har endast det arktiska och boreala bältet beaktats (skandinaviska utbredningskartor finnas i särskilt arkiv), men samlingen kan lätt kompletteras även med andra områden. Hittills är antalet kartor över arter utanför detta område ej stort, men det är statt i hastig tillväxt. Kartor över Sydafrikas, Indonesiska övärldens och Sydamerikas arter ser man redan nu då och då i litteraturen. Givetvis är samlingen icke fullständig. Nästan dagligen hittas nya arbeten innehållande utbredningskartor och nästan varje utlandspost bringar nya bidrag. Ett kontinuerligt arbete fordras således för att hålla arkivet up to date.

Låt oss på måfå slå upp ett blad i arkivet. *Rubus Chamaemorus*, hjortron, faller upp. Tre totalarealkartor finnas (av Meusel 1943, Firbas 1947 och Raymond 1950); dessutom NW. Europa Hultén 1950; Polen och Litauen Hryniewiecki 1932; Amerika Raup 1947; Alaska och Yukon Hultén 1946; Aleuterna Hultén 1937; Kamtchatka Hultén 1929; Nova Scotia Roland 1945. Eller låt oss ta ett annat exempel, *Carex capitata*. Två totalarealkartor: Hegi 1939 och Raymond 1950; dessutom Nord- och Sydamerika Steffen 1939; Nordamerika Rousseau 1931; NW. Europa Hultén 1950; Centraleuropa Pampanini 1903; Kaukasus Grossheim 1940; Asien Kreczetowicz 1941; Grönland Böcher 1950; Alaska och Yukon Hultén 1942; Labrador Raymond 1951. — Dessa båda exempel ge en ungefärlig uppfattning av vad som finnes att hämta i arkivet.

Det är givetvis vår avsikt att i den mån resurserna medgiva förkovra detta arkiv och efter hand införa nytillkommet material. Även om arbetskraften på museet ej skulle räcka till för denna uppgift är det redan föreliggande materialet av utomordentlig betydelse för den som vill studera kärlväxternas utbredningsförhållanden.

En ungefärlig beräkning ger vid handen, att omkring 30000 kartor för närvarande finnas representerade i samlingen. Så vitt bekant finnes intet sådant arkiv vid någon annan institution.

Vid begagnandet av samlingen måste man givetvis taga hänsyn till synonymiken, men vartefter den begagnas och kritiskt genomgås, kunna synonymer påskrivas och läggas tillsammans så att allt kartmaterial hänförligt till samma art ligger på ett ställe och kan tagas ut omedelbart.

Förutom detta internationella kartarkiv har museet som ovan nämnts sedan slutet av 1940-talet ett arkiv av utbredningskartor för våra kärlväxter inom Fennoskandia. Det är ordnat på ungefär samma sätt endast med den skillnaden att arken förvaras liggande liksom i ett herbarium.

Detta har befunnits opraktiskt, då det är tungt och tidskrävande att lyfta packarna. Vid uppläggningen av det nya internationella kartarkivet har därför i stället vertikalskåp kommit till användning.

Summary.

An archive of maps showing the distribution of plants has been gradually built up at the Botanical Department of the Swedish Museum of Natural History, Stockholm.

Linnæus and his pupils did not publish maps of the distribution of plants. Such maps did not appear until the beginning of the 19th century. First they were "line-maps", where the area of the species was enclosed by a line; later dot-maps were introduced. The first real dot-maps showing every place where the plant concerned was known to occur were those of Hoffmann in his "Pflanzenarealstudien in den Mittelrheingegenden" 1867–69. This method was not generally adopted before about 1909, first in Scandinavia and Finland. Nowadays it is commonly used the world over. Today the number of maps of plant distribution exceeds 40,000. It is therefore extremely difficult, or rather impossible, to procure all the published maps of a given species. We have "Index Londinensis" as a registration of the botanical illustrations, but there is no work in existence listing the distributional maps of plants.

Instead of making an index of this kind we have established at the Botanical Department of the Swedish Museum of Natural History (Riksmuseum), Stockholm, an archive of such maps. The maps have been cut out of books or, if a book is not available for cutting, we use a copying machine giving positive reproductions. They are then pasted on pieces of cardboard measuring 38 × 26 cm and filed vertically in drawers. Three cabinets about 135 cm high with 4 drawers in each have been filled with approximately 30,000 distributional maps.

To date, chiefly maps of arctic or boreal species have been dealt with, but the collection can easily be supplemented with the maps — they are but few so far — that cover the tropical belt and the southern hemisphere. New maps are being published daily the world over and it will be a constant task to keep the collection up to date. As far as our resources permit we intend to do so.

Eric Hultén.

On the Occurrence of Olacaceous Pollen Grains in Eocene Deposits in Germany.

Spores described as *Sporites efflatus* by R. Potonié (Arb. Inst. Paläobot. Petrogr. Brennsteine, Vol. 4, Berlin 1934) and tentatively referred by him to the Cyatheaceae correspond to a very singular type of pollen grains so far only met with in three genera of the Olacaceae, viz. *Anacolosa*, *Cathedra*, and *Ptychopetalum*. These genera occur, although sparingly, in the tropics

of America, Africa, and Asia. *Sporites efflatus* will henceforth be referred to as *Anacolosidites efflatus* (R. Pot.).

Mrs. E. M. Reid and Miss M. E. J. Chandler have described remains of olacaceous plants from the Eocene London Clay flora ("The London Clay Flora", London 1933). None of these come, however, from the three genera mentioned.

As indicated on p. x in "Pollen Morphology and Plant Taxonomy. I. Angiosperms" (Uppsala 1952), I was able to identify, in 1950, olacaceous pollen grains in Tertiary material from South America. These grains were of the *Anacolosa* type. Later I. Cookson and K. M. Pike in their interesting paper "Some dicotyledonous pollen types from Cainozoic deposits in the Australian region" (Austral. J. Bot. 2: 197–219, 1954) established the genus *Anacolosidites* for fossil pollen grains of this type.

G. Erdtman.

The Auxin Balance during Germination in Untreated Maize Kernels and in Maize Kernels Treated with Indole Acetic Acid.

(Preliminary report.)

In order to ascertain whether externally administered indole acetic acid (hereafter called IA) is chemically changed in germinating maize, dry maize kernels were treated with water or with solutions of IA, 10 and 100 mg per litre respectively. Afterwards free and bound auxin were extracted from the kernels with ether, either immediately after treatment or 24 hours after treatment, during which time the kernels had lain on wet filter paper, in the same way as in earlier investigations on the auxin balance in other plant parts (Hemberg 1951, 1954 *a* and *b*). It was found that immediately after treatment the content of free acid auxin in the treated kernels is higher than in the untreated ones; in those treated with 100 mg/litre it is 28 times greater than in the untreated ones. The content of bound acid auxin in the same kernels is only 5 times greater in those treated with 100 mg/litre than in the untreated ones. As regards the kernels that lay for 24 hours after treatment, on the other hand, the content of bound acid auxin in the kernels treated with 100 mg/litre is 12 times higher than in the untreated ones, whereas the content of free auxin in the same kernels is only about 5 times greater. Thus, if IA is administered to maize kernels which are then allowed to germinate, a great part of this is changed into bound auxin within the next 24 hours.

Untreated maize kernels that had swelled in water for three hours, were examined with regard to their content of free and bound acid auxin and this was compared with the content of the same auxin fractions in maize kernels that after swelling in water had lain on wet filter paper in large petri dishes for a further 21 hours. The first-mentioned kernels contain comparatively much bound auxin and relatively little free auxin, while in the case of the latter the content of free auxin had increased at the expense of the bound.

The results will be published in greater detail in the near future.

LITERATURE.

HEMBERG, T., 1951: Rooting experiments with hypocotyles of Phaseolus vulgaris L. — Physiol. Plant. 4: 358. Köbenhavn.

—»—, 1954 *a:* Studies on the occurrence of free and bound auxins and of growth-inhibiting substances in the potato tuber. — Ibidem, 7: 312.

—»—, 1954 *b:* The relation between the occurrence of auxin and the rooting of hypocotyls in Phaseolus vulgaris L. — Ibidem, 7: 323.

The Department of Botany of the Royal Pharmaceutical Institute, Stockholm.

Torsten Hemberg.

NOTISER.

Doktorsdisputationer. För vinnande av agronomie doktorsgrad försvarade vid Lantbrukshögskolan agron. lic. James Mac Key den 10 april 1954 en avhandling "Neutron and X-ray experiments in wheat and a revision of the speltoid problem" och agron. lic. Carl Gustaf von Hofsten den 25 maj en avhandling »Studier över släktet *Taraxacum* Wigg. med särskild hänsyn till gruppen *Vulgaria* Dt i Skandinavien».

Utmärkelser. Kungl. Vetenskapsakademiens större Linné-medalj i silver har tilldelats dr K. H. Rechinger, Naturhistorisches Museum, Wien, för hans insatser vid utgivandet av prof. G. Samuelssons efterlämnade manuskript och mr Henrik J. Vougt, Pomona, Calif., för hans medverkan vid staten Californias gåva till Riksmuseets botaniska avdelning av en sektion av ett 2400-årigt sequoia-träd. Akademien har vidare tilldelat prof. Carl Skottsberg det Letterstedtska författarpriset för arbetet "The vegetation of the Juan Fernandez Islands". Professors namn har tillagts föreståndaren vid Palynologiska laboratoriet, Bromma, fil. dr Gunnar Erdtman.

Riksmuseets botaniska avdelning. Museiassistenten vid avdelningen, fil. dr Gustaf Haglund har fr. o. m. den 1 maj 1954 utnämnts till intendent. Till e. o. amanuens har fr. o. m. den 1 juni utnämnts fil. lic. Olof Rune, Uppsala.

Statens växtskyddsanstalt. Fil. dr K. I. E. Granhall, Balsgård, Fjälkestad, har fr. o. m. den 1 jan. 1955 utnämnts till föreståndare för anstalten, tillika föreståndare för dess upplysningsavdelning.

Göteborgs botaniska trädgård. Docent Gunnar Degelius, Uppsala, har fr. o. m. den 1 dec. 1954 utnämnts till intendent vid trädgården.

Tryckningsanslag. För tryckningen av ett arbete »Floran i nordöstra delen av Sjuhäradsbygden», publicerat i Svensk Botanisk Tidskrifts 3. häfte för i år, har notarien fil. kand. G. A. Westfeldt, Borås, av Statens naturvetenskapliga forskningsråd tilldelats ett anslag å 3 500 kronor. För tryckningen av Svensk Botanisk Tidskrift under år 1955 har rådet beviljat Svenska Botaniska Föreningen ett anslag å 20 000 kronor.

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